TABLE

—FOR—

FINDING THE HOUR ANGLE

WITHOUT LOGARITHMS.

PREFACE.

———

This Table was prepared for the use of Surveyors in Canada, to enable them to find the Hour Angle from a morning or afternoon altitude of the sun without the use of Logarithms, with sufficient accuracy to determine the Azimuth of Polaris at any time without waiting for an elongation (a Table for which is in preparation).

This Table, however, gives the Hour Angle so close that it is available for Navigators, the error varying from 0 to 4 seconds, the greatest error occuring where the Declination is 0, the Latitude 58 and the Altitude 28° 45'.

It can be used in the Northern or Southern Hemisphere between the Latitudes 40° and 60°.

EXPLANATION OF THE TABLE.

The column headed Alt. contains the altitudes of the sun's centre corrected for Parallax and Refraction.

The column headed H. A. contains the Hour Angle corresponding to the Altitude which is on the same line, and to the Latitude and Declination which is above it.

The column headed D. gives the variation of the Hour Angle for one minute of Altitude.

The Table is computed to the nearest second for every Degree of Declination from 0 to 24 N., for every degree of Latitude from 40 to 59 N., and for every 30 minutes of Altitude within limits of four degrees.

Bessels' Refractions from Altitude 24° to 44° will be found on page

METHOD OF USING THE TABLE.

(1.) On the day of observation the observer shall note the Declination of the sun, and consulting the Table, shall time his observation, so that it shall fall within the limits of the Altitudes for that degree of Declination and those of the one following.

Having taken his Altitude and corrected it for Refraction, Parallax and Semidiameter, he shall take from the Table the Hour Angle due to the next lower Altitude, next lower Latitude and next lower Declination. Multiply the minutes and seconds of the corrected observed Altitude by the number under D, and apply it to the Hour Angle with the sign minus.

Multiply the difference between the Hour Angles due to the two successive degrees of Latitude between which lies the Latitude of the place, by the minutes and seconds in the latter and apply to the Hour Angle with the sign minus. Call the result A.

Proceed in the same manner, but using the next higher Declination, and call the result B.

Subtract A from B, multiply the difference by the minutes and seconds of the Declination, add the product to A. The result will be the Hour Angle.

N.B.—The result of each of those multiplications is seconds of time.

The following examples will illustrate the method:

EXAMPLE 1.

	°	′	″	or	°	′
Corrected Altitude............	41	48	20	or	41	48.33
Latitude of place	46	27	10	"	46	27.17
Dec'n corrected for Lon........	19	23	38	"	19	23.63

	h.	m.	sec.		h.	m.	sec.
Tabular Hour Angle, Dec. 19°.........	3	17	9				
18.33×6 = 109.97 (sec.) .... =	—	1	50				
$27.17 \times 1.83 = 49.72$ .... =	—		49.7		3	14	29.3 = A
Tabular Hour Angle, Dec. 20..........	3	21	22				
18.33×6 = 109.97 (sec.) .... =	—	1	50				
$27.17 \times 1.62 = 44.01$ .... =	—		44		3	18	48 = B
				B–A =		4	18.7

B–A = 4.31 which multiplied by 23.63 gives 101.9 (sec.) .. =   1   41.9

Adding to A gives Hour Angle   3   16   11.2

EXAMPLE 2.

	°	′	″	or	°	′
Corrected Altitude	39	14	50	or	39	14.83
Latitude of place...	57	12	40	"	57	12.67
Dec'n corrected for Lon	22	9	20	"	22	9.33

	h.	m.	sec.		h.	m.	sec.
Tabular Hour Angle, Dec. 22	3	25	32				
$14.83 \times 7.9 = 117.2$ (sec.)................ =	—	1	57.2				
$12.67 \times 3 = 38$ .... =	—		38.0		3	22	56.8=A
Tabular Hour Angle, Dec. 23	3	32	3				
$14.83 \times 7. 8 = 115.7$ (sec.).... .... =	—	1	55.7				
$12.67 \times 2.65 = 33.6$ .... =	—		33.6		3	29	33.7=B
					6	36.9= B–A	

$6.62 \times 9.33 = 61.8$ (sec.)......... .... =   —   1   1.8

Adding to A gives Hour Angle .... =   3   23   58.6

(2.)   If the minutes of the Observed Altitude when corrected lie between 15 and 30, or between 45 and 60, and the minutes of the Latitude and Declination are each greater than 30, or if any two of those three quantities fulfil these conditions, take out the Hour Angle due to the next higher Declination, Latitude and Altitude.   Proceed as in (1) but using the sign plus where minus is mentioned, and subtracting from instead of adding the final result to A.

The following example will illustrate the method:

EXAMPLE.

Corrected Altitude	25	47	20
Latitude	56	34	40
Dec'n corrected for Lon.	5	36	10

Hour Angle, Dec. 6, Lat. 57, Alt. 26...	3	18	36
12 40 or 12.7 × 8.8 = 111.8 .... =	+	1	51.8
25 20 or 25.3 × 5.4 = 113.8 .... =	+	1	53.8
	3	22	21.6 = A

Hour Angle, Dec. 5, Lat. 57, Alt. 26...	3	10	44	
12.7 × 9 = 114.3 .... =	+	1	54.3	
25.3 × 4.9 = 124.0.. .... =	+	2	4.0	
	3	14	42.3 = B	
		7	39.3 = A-B	
7.6 × 23.8 = 180.9 =		3	0.9	
A	=3	22	21.6	
Hour Angle....	3	19	20.7	

(5)

DECLINATION 0

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° '	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s
30 0	17 1	6.0	14 2	6.1	10 52	6.3	7 29	6.5	3 52	6.7	0 0	7.0	55 51	7.2	51 24	7.5	46 36	7.9	41 23	8.2	35 44	8.7
30 30	14 1	6.0	10 58	6.2	7 42	6.4	4 13	6.6	0 30	6.8	56 31	7.0	52 15	7.3	47 39	7.6	42 40	8.0	37 17	8.4	31 25	8.8
31 0	11 1	6.1	7 52	6.2	4 31	6.4	0 56	6.6	57 6	6.9	53 0	7.1	48 35	7.4	43 50	7.7	38 41	8.1	33 6	8.5	27 0	9.0
31 30	7 59	6.1	4 45	6.3	1 18	6.5	57 37	6.7	53 40	6.9	49 27	7.2	44 53	7.5	39 58	7.8	34 39	8.2	28 50	8.7	22 30	9.2
32 0	4 55	6.1	1 36	6.3	58 3	6.5	54 16	6.8	50 12	7.0	45 51	7.3	41 8	7.6	36 3	8.0	30 32	8.4	24 30	8.9	17 53	9.4
32 30	1 51	6.2	58 26	6.4	54 47	6.6	50 53	6.8	46 42	7.1	42 12	7.4	37 20	7.7	32 4	8.1	26 20	8.5	20 4	9.1	13 10	9.7
33 0	58 45	6.3	55 14	6.4	51 29	6.7	47 28	6.9	43 9	7.2	38 30	7.5	33 28	7.8	28 1	8.2	22 4	8.7	15 32	9.3	8 19	10.0
33 30	55 37	6.3	52 1	6.5	48 9	6.7	44 1	6.9	39 34	7.3	34 45	7.6	29 33	7.9	23 54	8.4	17 42	8.9	10 53	9.5	3 20	10.3
34 0	52 27	6.3	48 45	6.5	44 47	6.8	40 13	7.0	35 55	7.3	30 57	7.7	25 34	8.0	19 41	8.5	13 15	9.0	6 7	9.7	58 11	10.6

DECLINATION 0

Lat. N.	50 H.A.	50 D.	51 H.A.	51 D.	52 H.A.	52 D.	53 H.A.	53 D.	54 H.A.	54 D.	55 H.A.	55 D.	56 H.A.	56 D.	57 H.A.	57 D.	58 H.A.	58 D.	59 H.A.	59 D.
ALT.	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s
° '																				
24 0	22 59	7.4	18 57	7.7	14 36	7.9	9 55	8.3	4 51	8.7	59 21	9.1	53 20	9.6	46 45	10.2	39 28	10.9	31 22	11.7
24 30	19 18	7.4	15 7	7.7	10 38	8.1	5 46	8.4	0 31	8.8	54 47	9.2	48 32	9.8	41 39	10.4	34 1	11.2	25 30	12.1
25 0	15 35	7.6	11 15	7.8	6 35	8.1	1 34	8.5	2 56 7	9.0	50 10	9.5	43 38	10.0	36 26	10.7	28 26	11.5	19 26	12.5
25 30	11 48	7.6	7 21	7.9	2 32	8.3	2 57 19	8.7	51 38	9.1	45 26	9.6	38 38	10.2	31 5	11.0	22 40	11.9	13 10	13.0
26 0	8 0	7.7	2 3 23	8.0	2 58 24	8.4	52 59	8.8	47 5	9.3	40 38	9.8	33 31	10.5	25 36	11.3	16 44	12.3	6 39	13.6
26 30	4 10	7.8	59 23	8.1	54 13	8.6	48 35	8.9	42 27	9.5	35 43	10.0	28 16	10.9	19 58	11.6	10 35	12.8	1 59 51	14.3
27 0	2 0 17	7.9	55 19	8.2	49 56	8.6	44 7	9.1	37 41	9.6	30 42	10.3	22 53	11.1	14 8	12.1	4 12	13.3	52 43	15.1
27 30	56 20	8.0	51 12	8.4	45 38	8.8	39 34	9.3	32 54	9.8	25 33	10.6	17 21	11.4	8 6	12.5	1 57 32	14.0	45 11	16.1
28 0	52 20	8.1	47 1	8.5	41 15	8.9	34 55	9.4	27 58	9.9	20 16	10.8	11 38	11.6	1 50	12.9	50 32	14.5	37 8	17.1

DECLINATION 1 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s
30 0	21 23	5.9	18 36	6.0	15 39	6.2	12 30	6.4	9 9	6.6	5 33	6.8	1 43	7.1	57 35	7.3	53 8	7.6	48 20	8.0	43 8	8.3
30 30	18 26	5.9	15 35	6.1	12 33	6.3	9 19	6.4	5 51	6.6	2 9	6.9	58 11	7.1	53 56	7.4	49 20	7.7	44 21	8.0	38 58	8.5
31 0	15 28	5.9	12 33	6.1	9 25	6.3	6 6	6.5	2 32	6.7	58 43	6.9	54 38	7.2	50 14	7.5	45 29	7.8	40 20	8.2	34 44	8.6
31 30	12 30	6.0	9 29	6.2	6 17	6.4	2 51	6.5	59 11	6.8	55 15	7.0	51 2	7.3	46 30	7.6	41 35	7.9	36 15	8.3	30 26	8.8
32 0	9 30	6.1	6 24	6.2	3 6	6.4	59 35	6.6	55 48	6.8	51 45	7.1	47 24	7.4	42 42	7.7	37 37	8.1	32 5	8.5	26 2	9.0
32 30	6 28	6.1	3 17	6.2	59 54	6.4	56 17	6.7	52 23	6.9	48 13	7.2	43 43	7.5	38 51	7.8	33 35	8.2	27 50	8.7	21 33	9.2
33 0	3 26	6.1	0 10	6.3	56 41	6.5	52 57	6.7	48 56	7.0	44 38	7.2	39 59	7.6	34 57	7.9	29 30	8.3	23 30	8.8	16 58	9.4
33 30	0 22	6.2	57 0	6.3	53 25	6.6	49 35	6.8	45 27	7.1	41 1	7.3	36 12	7.7	30 59	8.1	25 20	8.5	19 6	9.0	12 17	9.6
34 0	57 17	6.2	53 50	6.3	50 8	6.6	46 11	6.8	41 55	7.1	37 20	7.4	32 22	7.7	26 57	8.1	21 5	8.6	14 37	9.1	7 28	9.8

(8)

DECLINATION 1 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h	s	3h	s	3h	s	3h	s	3h	s	3h	s	3h	s	2h	s	2h	s	2h	s
24 0	29 3	7.2	25 19	7.5	21 18	7.7	17 0	8.1	12 20	8.4	7 16	8.8	1 47	9.3	55 44	9.7	49 10	10.3	41 52	11.1
24 30	25 26	7.3	21 35	7.5	17 26	7.8	12 58	8.2	8 7	8.5	2 53	8.9	2h 57 9	9.4	50 53	9.9	44 0	10.6	36 19	11.3
25	21 47	7.3	17 51	7.7	13 31	7.9	8 53	8.3	3 52	8.6	2h 58 25	9.1	52 27	9.6	45 55	10.1	38 42	10.9	30 39	11.7
25 30	18 7	7.4	14 0	7.7	9 33	8.0	4 45	8.4	2h 59 33	8.8	53 52	9.2	47 40	9.8	40 51	10.4	33 15	11.1	24 48	12.1
26 0	14 25	7.5	10 9	7.7	5 33	8.1	2h 0 34	8.5	55 9	8.9	49 15	9.4	42 47	10.0	35 39	10.7	27 42	11.5	18 46	12.5
26 30	10 40	7.6	6 15	7.9	2h 1 29	8.2	56 19	8.6	50 42	9.1	44 33	9.6	37 48	10.2	30 19	10.9	21 58	11.8	12 31	13.0
27 0	6 52	7.6	2h 2 18	8.0	57 22	8.3	52 1	8.8	46 10	9.2	39 46	9.8	32 42	10.4	24 51	11.3	16 3	12.2	6 2	13.5
27 30	2h 3 3	7.8	58 19	8.1	53 12	8.5	47 38	8.9	41 33	9.4	34 52	10.0	27 29	10.7	19 13	11.6	9 56	12.7	1 59 16	14.2
28 0	59 10	7.8	54 16	8.2	48 58	8.6	43 11	9.0	36 51	9.5	29 52	10.2	22 7	10.9	13 26	11.9	3 34	13.2	52 10	14.9

(9)

DECLINATION 2 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	2h m s	s	2h m s	s	2h m s	s
30 0	25 37	5.8	23 3	6.0	20 18	6.1	17 23	6.3	14 15	6.5	10 55	6.7	7 21	6.9	3 32	7.2	59 25	7.4	54 59	7.7	50 11	8.0
30 30	22 43	5.9	20 4	6.0	17 15	6.2	14 14	6.3	11 2	6.6	7 36	6.7	3 55	7.0	59 58	7.2	55 42	7.5	51 7	7.8	46 10	8.1
31	19 48	5.9	17 5	6.0	14 11	6.2	11 5	6.4	7 47	6.6	4 15	6.8	0 27	7.1	56 23	7.3	51 59	7.6	47 15	8.0	42 6	8.3
31 30	16 52	5.9	14 4	6.1	11 5	6.2	7 54	6.4	4 30	6.6	0 52	6.9	56 57	7.1	52 44	7.4	48 12	7.7	43 17	8.1	37 57	8.4
32	13 55	5.9	11 3	6.1	7 59	6.3	4 42	6.5	1 12	6.7	57 27	7.0	53 24	7.2	49 4	7.5	44 22	7.8	39 17	8.2	33 45	8.6
32 30	10 57	5.9	8 0	6.2	4 51	6.3	1 28	6.5	57 52	6.8	54 0	7.0	49 50	7.3	45 20	7.6	40 29	8.0	35 13	8.3	29 28	8.7
33	7 58	6.0	4 56	6.2	1 41	6.4	58 13	6.6	54 30	6.8	50 30	7.1	46 13	7.4	41 34	7.7	36 32	8.1	31 4	8.5	25 6	8.9
33 30	4 58	6.1	1 50	6.2	58 30	6.4	54 56	6.6	51 6	6.9	46 59	7.1	42 33	7.5	37 45	7.8	32 32	8.2	26 57	8.6	20 38	9.0
34	1 56	6.1	58 43	6.3	55 18	6.5	51 37	6.7	47 40	6.9	43 25	7.2	38 50	7.6	33 52	7.9	28 28	8.3	22 33	8.7	16 4	9.2

DECLINATION 2 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° '	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	2h m s	s	2h m s	s
24 0	34 56	7.1	31 30	7.4	27 48	7.6	23 50	7.9	19 32	8.2	14 54	8.6	9 52	9.0	4 23	9.4	58 22	10.0	51 45	10.7
24 30	31 24	7.2	27 50	7.4	24 1	7.7	19 52	8.0	15 27	8.3	10 38	8.7	5 24	9.1	59 41	9.6	53 24	10.2	46 29	10.9
25 0	27 50	7.2	24 9	7.5	20 11	7.8	15 55	8.1	11 18	8.4	6 18	8.8	0 52	9.3	54 54	9.7	48 21	10.4	41 6	11.2
25 30	24 14	7.3	20 25	7.6	16 19	7.9	11 54	8.2	7 7	8.6	1 55	9.0	56 15	9.5	50 2	9.9	43 11	10.7	35 35	11.5
26 0	20 36	7.4	16 40	7.6	12 25	7.9	7 51	8.3	2 52	8.7	57 28	9.1	51 34	9.6	45 5	10.0	37 55	10.9	29 55	11.8
26 30	16 56	7.4	12 52	7.7	8 28	8.0	3 44	8.4	58 34	8.8	52 57	9.3	46 48	9.7	40 1	10.2	32 31	11.3	24 6	12.2
27 0	13 15	7.5	9 2	7.8	4 20	8.2	59 33	8.5	54 12	9.0	48 21	9.5	41 56	9.9	34 51	10.3	26 58	11.6	18 5	12.8
27 30	9 31	7.5	5 9	7.9	0 26	8.2	55 20	8.6	49 46	9.1	43 42	9.7	36 58	10.1	29 33	10.4	21 58	11.9	11 52	13.3
28 0	5 44	7.6	1 13	7.9	56 20	8.3	51 2	8.7	45 15	9.2	38 54	9.9	31 54	10.3	24 6	10.5	15 22	12.2	5 19	13.9

(II)

DECLINATION 3 N

Lat. N	40		41		42		43		44		45		46		47		48		49		50	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	2h m s	s
30 0	29 45	5.7	27 22	5.9	24 49	6.0	22 7	6.2	19 13	6.3	16 7	6.5	12 48	6.7	9 15	6.9	5 28	7.2	1 22²	7.5	56 57	7.8
30 30	26 53	5.7	24 26	5.9	21 49	6.0	19 2	6.2	16 3	6.4	12 52	6.6	9 26	6.8	5 47	7.0	1 52²	7.3	57 38	7.6	53 3	7.9
31 0	24 1	5.7	21 30	6.0	18 48	6.1	15 55	6.2	12 51	6.4	9 34	6.6	6 3	6.9	2 17²	7.1	58 14	7.4	53 51	7.7	49 7	8.0
31 30	21 7	5.7	18 31	6.0	15 45	6.1	12 48	6.3	9 38	6.5	6 17	6.7	2 37²	6.9	58 44	7.2	54 33	7.4	50 1	7.8	45 7	8.1
32 0	18 13	5.7	15 33	6.0	12 42	6.2	9 39	6.4	6 24	6.5	2 55²	6.8	59 10	7.0	55 9	7.2	50 50	7.5	46 8	7.9	41 3	8.2
32 30	15 18	5.9	12 34	6.1	9 35	6.2	6 28	6.4	3 9²	6.6	59 32	6.8	55 41	7.0	51 33	7.3	47 4	7.6	42 12	8.0	36 56	8.4
33 0	12 21	5.9	9 32	6.1	6 31	6.2	3 18	6.4	59 51	6.6	56 9	6.9	52 10	7.1	47 53	7.4	43 15	7.7	38 13	8.1	32 45	8.5
33 30	9 24	5.9	6 30	6.1	3 24	6.3	0 5	6.5	56 32	6.7	52 43	6.9	48 36	7.2	44 11	7.5	39 23	7.9	34 10	8.2	28 29	8.7
34 0	6 26	6.0	3 26	6.2	0 15	6 3	56 51²	6.5	53 11	6.7	49 15	7.0	45 0	7.2	40 25	7.6	35 27	8.0	30 3	8.3	24 8	8.8

(12)

DECLINATION 3 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
24 0	40 40	6.9	37 30	7.2	34 6	7.4	30 27	7.7	26 30	8.0	22 15	8.3	17 38	8.7	12 37	9.1	7 9	9.6	1 8	10.1
24 30	37 12	7.0	33 55	7.2	30 23	7.5	26 36	7.8	22 31	8.1	18 6	8.4	13 18	8.8	8 5	9.2	2 22	9.7	56 6	10.3
25 0	33 41	7.1	30 18	7.3	26 39	7.6	22 43	7.8	18 29	8.2	13 53	8.5	8 54	8.9	3 28	9.4	57 31	9.9	50 57	10.5
25 30	30 9	7.1	26 39	7.4	22 52	7.6	18 48	7.9	14 24	8.2	9 38	8.6	4 27	9.0	58 47	9.5	52 34	10.1	45 42	10.7
26 0	26 36	7.2	22 58	7.4	19 4	7.7	14 51	8.0	10 17	8.4	5 20	8.7	59 56	9.2	54 2	9.7	47 32	10.3	40 20	11.0
26 30	23 1	7.2	19 15	7.5	15 13	7.8	10 50	8.1	6 6	8.5	0 58	8.9	55 21	9.3	49 11	9.9	42 24	10.5	34 51	11.3
27 0	19 24	7.3	15 31	7.6	11 19	7.9	6 47	8.2	1 52	8.6	56 32	9.1	50 41	9.5	44 15	10.1	37 8	10.8	29 12	11.6
27 30	15 45	7.4	11 44	7.7	7 23	7.9	2 41	8.3	57 35	8.7	52 0	9.1	45 57	9.7	39 12	10.3	31 45	11.1	23 24	12.0
28 0	12 4	7.4	7 54	7.7	3 25	8.0	58 32	8.4	53 14	8.8	47 26	9.2	41 5	9.8	34 3	10.6	26 13	11.4	17 25	12.4

DECLINATION 4 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
30 0	33 46	5.7	31 34	5.8	29 13	5.9	26 42	6.1	24 1	6.2	21 10	6.4	18 6	6.6	14 49	6.8	11 18	7.1	7 31	7.3	3 26	7.6
30 30	30 57	5.7	28 40	5.8	26 15	6.0	23 40	6.1	20 54	6.3	17 57	6.4	14 48	6.7	11 25	6.9	7 47	7.1	3 52	7.4	59 49	7.6
31 0	28 6	5.7	25 46	5.8	23 16	6.0	20 37	6.2	17 46	6.3	14 44	6.5	11 29	6.7	7 59	6.9	4 14	7.2	0 11 (2)	7.5	55 49	7.7
31 30	25 15	5.7	2 51	5.9	20 17	6.0	17 33	6.2	14 37	6.3	11 29	6.6	8 8	6.8	4 31	7.0	0 39 (2)	7.3	56 28	7.6	51 57	7.8
32 0	22 23	5.8	19 55	5.9	17 16	6.1	14 27	6.2	11 26	6.4	8 13	6.6	4 45	6.8	1 2 (2)	7.1	57 2	7.4	52 42	7.7	48 1	7.9
32 30	19 30	5.8	16 58	5.9	14 15	6.1	11 21	6.3	8 14	6.4	4 55	6.7	1 21 (2)	6.9	57 30	7.2	53 22	7.5	48 54	7.8	44 2	8.1
33 0	16 37	5.8	14 0	6.0	11 12	6.1	8 13	6.3	5 1	6.5	1 35 (2)	6.7	57 54	7.0	53 57	7.3	49 40	7.6	45 2	7.9	40 0	8.2
33 0	13 42	5.8	11 1	6.0	8 8	6.2	5 4	6.3	1 46 (2)	6.5	58 14	6.8	54 26	7.0	50 20	7.4	45 55	7.7	41 7	8.0	35 54	8.3
34 0	10 47	5.9	8 1	6.0	5 3	6.2	1 53	6.4	58 30	6.6	54 51	6.8	50 56	7.1	46 42	7.5	42 7	7.8	37 9	8.1	31 44	8.4

DECLINATION 4 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
24 0	46 16	6.9	43 21	7.1	40 14	7.3	36 52	7.6	33 15	7.8	29 21	8.1	25 8	8.5	20 33	8.9	15 34	9.3	10 6	9.6
24 30	42 50	6.9	39 49	7.1	36 35	7.4	33 6	7.6	29 21	7.9	25 18	8.2	20 55	8.6	16 9	9.0	10 56	9.5	5 14	10.0
25 0	39 24	7.0	36 16	7.2	32 55	7.4	29 19	7.7	25 25	8.0	21 12	8.3	16 39	8.7	11 41	9.1	6 15	9.6	0 18	10.2
25 30	35 55	7.0	32 41	7.2	29 13	7.5	25 29	7.8	21 26	8.1	17 4	8.4	12 19	8.8	7 9	9.2	1 29	9.8	2 55 15	10.3
26 0	32 26	7.1	29 5	7.3	25 29	7.6	21 37	7.9	17 25	8.2	12 53	8.5	7 57	8.9	2 33	9.4	56 39	9.9	50 9	10.6
26 30	28 55	7.1	25 27	7.4	21 43	7.6	17 42	7.9	13 21	8.3	8 38	8.6	3 30	9.1	57 54	9.6	51 44	10.1	44 55	10.8
27 0	25 22	7.2	21 47	7.4	17 55	7.7	13 45	8.0	9 15	8.4	4 21	8.8	59 0	9.2	53 9	9.8	46 43	10.4	39 34	11.1
27 30	21 48	7.2	19 5	7.5	14 5	7.7	9 46	8.0	5 5	8.5	0 0	8.9	54 26	9.3	48 19	10.0	41 35	10.6	34 6	11.4
28 0	18 11	7.3	14 21	7.5	10 13	7.8	5 44	8.1	0 52	8.6	55 34	9.0	49 47	9.4	43 24	10.1	36 21	10.8	28 29	11.6

DECLINATION 5 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° '	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
30 0	37 42	5.6	35 40	5.7	33 29	5.8	31 10	6.0	28 41	6.1	26 1	6.3	23 11	6.5	20 10	6.7	16 57	6.9	13 28	7.1	9 42	7.4
30 30	34 54	5.6	32 48	5.7	30 34	5.9	28 10	6.0	25 37	6.2	22 52	6.3	19 56	6.5	16 49	6.7	13 30	6.9	9 54	7.2	6 1	7.5
31 0	32 6	5.6	29 56	5.8	27 38	5.9	25 10	6.1	22 31	6.2	19 42	6.4	16 41	6.6	13 28	6.8	10 2	7.0	6 18	7.3	2 17	7.5
31 30	29 16	5.6	27 3	5.8	24 41	5.9	22 8	6.1	19 25	6.2	16 31	6.4	13 24	6.6	10 4	6.8	6 32	7.1	2 40	7.3	2 58 0	7.6
32 0	26 27	6.7	24 10	5.8	21 43	6.0	19 6	6.1	16 18	6.3	13 18	6.5	10 5	6.7	6 39	6.9	3 0	7.2	2 59 0	7.4	54 42	7.7
32 30	23 36	6.7	21 15	5.8	18 44	6.0	16 3	6.2	13 9	6.3	10 4	6.5	6 45	6.7	3 13	7.0	2 59 25	7.2	55 18	7.5	50 50	7.8
33 0	20 45	6.7	18 20	5.9	15 45	6.0	12 58	6.2	10 0	6.4	6 48	6.6	3 23	6.8	2 59 44	7.0	55 49	7.3	51 33	7.6	46 56	7.9
33 30	17 53	6.8	15 24	5.9	12 44	6.1	9 52	6.2	6 48	6.4	3 31	6.6	0 0	6.8	56 13	7.1	52 10	7.4	47 45	7.7	42 58	8.0
34 0	15 0	6.8	12 26	5.9	9 42	6.1	6 45	6.3	3 36	6.5	0 13	6.7	2 56 34	6.9	52 40	7.1	48 29	7.4	43 55	7.7	38 56	8.1

DECLINATION 5 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
24 0	51 44	6.8	49 4	7.0	46 12	7.2	43 8	7.4	39 49	7.6	36 15	7.9	32 24	8.2	28 13	8.6	23 40	9.0	18 42	9.4
24 30	48 21	6.8	45 35	7.0	42 37	7.2	39 26	7.5	36 0	7.7	32 17	8.0	28 17	8.3	23 55	8.7	19 11	9.1	14 0	9.6
25 0	44 58	6.8	42 0	7.0	39 1	7.2	35 42	7.5	32 8	7.8	28 17	8.1	29 7	8.4	19 35	8.8	14 38	9.2	9 13	9.7
25 30	41 33	6.9	38 35	7.1	35 24	7.3	31 57	7.0	28 15	7.9	24 15	8.2	19 54	8.5	15 11	8.9	10 2	9.4	4 23	9.9
26 0	38 6	6.9	35 2	7.1	31 44	7.4	28 10	7.6	24 19	7.9	20 10	8.3	15 39	8.6	10 44	9.0	5 21	9.5	59 27	10.0
26 30	34 39	7.0	31 28	7.2	28 2	7.4	24 21	7.7	20 21	8.0	16 2	8.3	11 20	8.7	6 13	9.1	0 37	9.7	54 27	10.2
27 0	31 10	7.0	27 52	7.2	24 19	7.5	20 29	7.8	16 21	8.1	11 52	8.5	6 59	8.9	1 39	9.3	55 47	9.8	49 20	10.4
27 30	27 40	7.1	24 15	7.3	20 34	7.6	16 30	7.9	12 18	8.2	7 38	8.6	2 33	9.0	57 0	9.5	50 53	10.0	44 7	10.6
28 0	24 8	7.1	20 36	7.3	16 47	7.6	12 40	7.9	8 12	8.3	3 21	8.7	58 4	9.1	52 16	9.6	45 53	10.2	38 48	10.8

DECLINATION 6 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° '	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
30 0	41 32	5.6	39 40	5.7	37 40	5.8	35 32	5.9	33 16	6.1	30 50	6.2	28 13	6.4	25 26	6.6	22 26	6.8	19 13	7.0	15 45	7.2
30 30	38 46	5.6	36 50	5.7	34 47	5.8	32 35	5.9	30 14	6.1	27 43	6.2	25 2	6.4	22 9	6.6	19 3	6.8	15 43	7.1	12 8	7.3
31 0	35 59	5.6	34 0	5.7	31 53	5.8	29 37	6.0	27 12	6.1	24 36	6.3	21 49	6.5	18 51	6.7	15 39	6.9	12 12	7.1	8 30	7.4
31 30	33 12	5.6	31 9	5.7	28 58	5.9	26 38	6.0	24 8	6.2	21 28	6.3	18 36	6.5	15 31	6.7	12 13	6.9	8 39	7.2	4 49	7.4
32 0	30 24	5.6	28 18	5.8	26 3	5.9	23 38	6.0	21 4	6.2	18 18	6.4	15 21	6.6	12 10	6.8	8 45	7.0	5 5	7.3	1 6 2	7.5
32 30	27 36	5.7	25 25	5.8	23 6	5.9	20 37	6.0	17 58	6.2	15 7	6.4	12 4	6.6	8 48	6.8	5 16	7.1	1 28 2	7.4	57 21	7.6
33 0	24 46	5.7	22 32	5.8	20 9	5.9	17 36	6.1	14 52	6.3	11 56	6.5	8 47	6.7	5 23	6.9	1 45 2	7.1	57 49	7.4	53 33	7.7
33 30	21 57	5.7	19 39	5.8	17 11	6.0	14 34	6.1	11 44	6.3	8 42	6.5	5 27	6.7	1 57 2	6.9	58 11	7.2	54 7	7.5	49 43	7.8
34 0	19 6	5.7	16 44	5.8	14 12	6.0	11 29	6.1	8 35	6.3	5 28	6.6	2 6	6.8	58 30	7.0	54 36	7.2	50 23	7.6	45 49	7.9

DECLINATION 6 N

Lat. N.		50		51		52		53		54		55		56		57		58		59	
ALT.		H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′		3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
24 0		57 5	6.7	54 39	6.9	52 3	7.1	49 14	7.3	46 13	7.5	42 58	7.8	39 27	8.1	35 38	8.4	31 30	8.8	26 59	9.2
24 30		53 45	6.7	51 14	6.9	48 31	7.1	45 36	7.4	42 28	7.6	39 5	7.9	35 25	8.2	31 26	8.5	27 7	8.9	22 25	9.3
25 0		50 24	6.7	47 47	7.0	44 58	7.2	41 56	7.4	38 41	7.7	35 9	7.9	31 21	8.3	27 12	8.6	22 42	9.0	17 47	9.4
25 30		47 2	6.8	44 18	7.0	41 24	7.2	38 15	7.4	34 52	7.7	31 12	8.0	27 14	8.4	22 55	8.7	18 14	9.1	13 6	9.6
26 0		43 39	6.8	40 49	7.0	37 48	7.3	34 32	7.5	31 1	7.8	27 13	8.1	23 5	8.4	18 36	8.8	13 42	9.3	8 21	9.8
26 30		40 14	6.9	37 19	7.1	34 11	7.3	30 48	7.6	27 8	7.9	23 11	8.2	18 53	8.5	14 13	8.9	9 7	9.4	3 31	9.9
27 0		36 49	6.9	33 47	7.1	30 32	7.4	27 1	7.6	23 13	7.9	19 7	8.3	14 39	8.6	9 47	9.1	4 27	9.5	2 58 36	10.0
27 30		33 22	6.9	30 13	7.1	26 51	7.4	23 13	7.7	19 16	8.0	15 0	8.4	10 21	8.7	5 17	9.2	2 59 44	9.6	53 36	10.2
28 0		29 54	7.0	26 39	7.2	23 9	7.5	19 22	7.7	15 16	8.0	10 50	8.5	6 0	8.8	0 43	9.3	54 55	9.7	48 31	10.3

(19)

DECLINATION 7 N

Lat. N	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
30 0	45 16	5.5	43 34	5.6	41 45	5.7	39 48	5.8	37 43	6.0	35 29	6.1	33 5	6.3	30 31	6.5	27 46	6.7	24 48	6.9	21 37	7.1
30 30	42 32	5.5	40 46	5.6	38 53	5.7	36 53	5.9	34 43	6.0	32 25	6.2	29 56	6.3	27 17	6.5	24 26	6.7	21 22	6.9	18 5	7.1
31 0	39 47	5.5	37 58	5.6	36 1	5.7	33 57	5.9	31 43	6.0	29 20	6.2	26 47	6.4	24 2	6.5	21 6	6.7	17 56	7.0	14 31	7.2
31 30	37 1	5.5	35 9	5.7	33 9	5.8	31 0	5.9	28 42	6.1	26 15	6.2	23 36	6.4	20 46	6.6	17 44	6.8	14 27	7.0	10 55	7.3
32 0	34 15	5.5	32 19	5.7	30 15	5.8	28 2	5.9	25 4	6.1	23 8	6.3	20 24	6.4	17 29	6.6	14 20	6.8	10 57	7.1	7 17	7.3
32 30	31 29	5.6	29 29	5.7	27 21	5.8	25 4	6.0	22 38	6.1	20 0	6.3	17 11	6.5	14 10	6.7	10 55	6.9	7 25	7.1	3 38₂	7.4
33 0	28 41	5.6	26 38	5.7	24 26	5.8	22 5	6.0	19 34	6.2	16 51	6.3	13 57	6.5	10 50	6.7	7 28	6.9	3 51	7.2	59 55	7.5
33 30	25 54	5.6	23 46	5.7	21 31	5.9	19 5	6.0	16 29	6.2	13 41	6.4	10 42	6.6	7 28	6.8	4 0	7.0	0 15₂	7.3	56 11	7.6
34 0	23 5	5.6	20 54	5.8	18 34	5.9	16 4	6.0	13 23	6.2	10 3	6.4	7 24	6.6	4 5	6.8	0 29	7.1	56 36₂	7.4	52 24	7.6

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	4h m s		4h m s		3h m s		3h		3h		3h		3h		3h		3h		3h	
24 0	2 19	6.6	0 7	6.8	57 45	6.9	55 13	7.2	52 28	7.4	49 31	7.7	46 0	7.9	42 51	8.2	39 6	8.6	35 6	9.0
24 30	59 2	6.6	56 44	6.8	54 17	7.0	51 38	7.2	48 46	7.4	45 41	7.7	42 21	8.0	38 45	8.3	34 49	8.6	30 33	9.0
25 0	55 43	6.6	53 20	6.8	50 47	7.1	48 1	7.3	45 3	7.5	41 50	7.7	38 22	8.0	34 36	8.4	30 30	8.7	26 3	9.1
25 30	52 24	6.7	49 55	6.9	47 15	7.1	44 23	7.3	41 18	7.6	37 58	7.8	34 21	8.1	30 25	8.4	26 0	8.8	21 29	9.2
26 0	49 3	6.7	46 29	6.9	43 43	7.1	40 44	7.4	37 31	7.6	34 3	8.0	30 17	8.2	26 12	8.5	21 45	8.9	16 52	9.3
26 30	45 42	6.8	43 2	6.9	40 0	7.2	37 3	7.4	33 43	7.7	30 0	8.0	26 11	8.3	21 50	8.7	17 17	9.0	12 12	9.5
27 0	42 19	6.8	39 35	7.0	36 34	7.2	33 21	7.5	29 53	7.7	26 7	8.0	22 3	8.4	17 36	8.8	12 46	9.2	7 27	9.6
27 30	38 55	6.8	36 3	7.0	32 57	7.3	29 37	7.5	26 1	7.8	22 6	8.1	17 52	8.5	13 13	8.8	8 11	10.3	2 38	9.8
28 0	35 30	6.9	32 32	7.1	29 10	7.3	25 51	7.6	22 7	7.9	18 3	8.2	13 36	8.6	8 49	9.0	3 33	9.4	57 45	10.0
28 30	32 4	6.9	28 59	7.1	25 39	7.4	22 3	7.6	18 10	8.0	13 57	8.3	9 21	8.7	4 20	9.1	58 50	9.6	52 40	10.1
29 0	28 37	6.9	25 25	7.2	21 58	7.5	18 14	7.7	14 11	8.0	9 48	8.4	5 1	8.8	50 47	9.2	54 3	9.8	47 42	10.3
29 30	25 8	7.0	21 49	7.3	18 14	7.5	14 22	7.8	10 10	8.1	5 36	8.5	0 38	9.0	55 19	9.4	49 10	9.9	42 33	10.6
30 0	21 37	7.0	18 11	7.3	14 28	7.6	10 27	7.9	6 6	8.2	1 21	8.6	56 10	9.0	50 20	9.5	44 12	10.0	37 14	10.8

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° '	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
30 0	48 57	5.4	47 24	5.6	45 44	5.7	43 58	5.8	42 4	5.9	40 1	6.0	37 50	6.2	35 29	6.4	32 57	6.6	30 14	6.7	27 19	7.0
30 30	46 13	5.4	44 37	5.6	42 55	5.7	41 4	5.8	39 6	5.9	37 0	6.1	34 44	6.3	32 18	6.4	29 41	6.6	26 52	6.8	23 50	7.0
31 0	43 30	5.5	41 51	5.6	40 4	5.7	38 10	5.8	36 8	6.0	33 57	6.1	31 37	6.3	29 6	6.5	26 23	6.6	23 29	6.8	20 21	7.1
31 30	40 46	5.5	39 3	5.6	37 13	5.7	35 16	5.9	33 9	6.0	30 54	6.1	28 29	6.3	25 53	6.5	23 5	6.7	20 4	6.9	16 49	7.1
32 0	38 1	5.5	36 15	5.6	34 22	5.8	32 20	5.9	30 10	6.0	27 50	6.2	25 20	6.3	22 38	6.5	19 45	6.7	16 38	7.0	13 16	7.2
32 30	35 17	5.5	33 27	5.7	31 30	5.8	29 24	5.9	27 9	6.1	24 45	6.2	22 10	6.4	19 23	6.6	16 23	6.8	13 10	7.0	9 41	7.2
33 0	32 31	5.5	30 38	5.7	28 37	5.8	26 27	5.9	24 8	6.1	21 39	6.2	18 59	6.4	16 6	6.6	13 0	6.8	9 40	7.1	6 4	7.3
33 30	29 45	5.6	27 48	5.7	25 43	5.8	23 30	6.0	21 6	6.1	18 32	6.3	15 46	6.4	12 48	6.6	9 36	6.8	6 9	7.1	2 25	7.4
34 0	26 58	5.6	24 58	5.7	22 49	5.8	20 31	6.0	18 3	6.1	15 24	6.3	12 33	6.4	9 29	6.7	6 10	6.9	2 36	7.2	2 58 44	7.4

DECLINATION 8 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	3^h m s	s	3^h m s	s	3^h m s	s	3^h m s	s	3^h m s	s	3^h m s	s	3^h m s	s	3^h m s	s	3^h m s	s	3^h m s	s
26 0	54 21	6.6	52 1	6.8	49 30	7.0	46 47	7.3	43 52	7.5	40 42	7.8	37 16	8.0	33 33	8.4	29 31	8.8	25 6	9.2
26 30	51 2	6.7	48 36	6.9	45 59	7.1	43 10	7.3	40 7	7.5	36 50	7.8	33 16	8.1	29 23	8.5	25 10	8.9	20 33	9.3
27 0	47 42	6.7	45 11	6.9	42 27	7.1	38 31	7.3	36 21	7.6	32 56	7.9	29 13	8.2	25 10	8.6	20 46	9.0	15 57	9.4
27 30	44 21	6.7	41 44	7.0	38 54	7.2	35 51	7.4	32 34	7.7	29 0	8.0	25 8	8.3	20 55	8.7	16 19	9.1	11 17	9.5
28 0	40 59	6.8	38 17	7.0	35 20	7.2	32 10	7.5	28 44	7.7	25 2	8.0	21 0	8.4	16 37	8.8	11 49	9.2	6 33	9.7
28 30	37 36	6.8	34 40	7.1	31 44	7.3	28 26	7.5	24 53	7.8	21 2	8.1	16 50	8.5	12 16	8.9	7 15	9.3	1 45	9.8
29 0	34 12	6.9	31 16	7.1	28 6	7.3	24 41	7.6	20 59	7.9	16 59	8.2	12 37	8.6	7 51	9.0	2 38^2	9.5	56 53^2	10.0
29 30	30 46	6.9	27 42	7.2	24 27	7.4	20 54	7.6	17 4	7.9	12 53	8.3	8 20	8.7	3 22^2	9.1	57 56	9.6	51 56	10.2
30 0	27 19	6.9	24 9	7.2	20 46	7.4	17 5	7.7	13 6	8.0	8 46	8.4	4 2	8.8	58 51^2	9.2	53 9	9.7	46 52	10.3

DECLINATION 9 N

Lat. N. Alt.	40 H.A.	40 D.	41 H.A.	41 D.	42 H.A.	42 D.	43 H.A.	43 D.	44 H.A.	44 D.	45 H.A.	45 D.	46 H.A.	46 D.	47 H.A.	47 D.	48 H.A.	48 D.	49 H.A.	49 D.	50 H.A.	50 D.
	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
30 0	52 32	5.4	51 0	5.5	49 39	5.6	48 2	5.7	46 19	5.9	44 27	6.0	42 28	6.1	40 19	6.3	38 1	6.5	35 22	6.5	32 52	6.8
30 30	49 50	5.4	48 24	5.5	46 51	5.6	45 11	5.8	43 23	5.9	41 27	6.0	39 24	6.2	37 11	6.3	34 47	6.5	32 8	6.5	29 27	6.9
31 0	47 8	5.4	45 38	5.5	44 2	5.6	42 18	5.8	40 27	5.9	38 28	6.0	36 19	6.2	34 1	6.3	31 33	6.5	28 53	6.7	26 1	6.9
31 30	44 25	5.4	42 53	5.6	41 13	5.7	39 26	5.8	37 30	5.9	35 26	6.0	33 14	6.2	30 51	6.4	28 17	6.6	25 31	6.7	22 33	7.0
32 0	41 42	5.4	40 6	5.6	38 23	5.7	36 32	5.8	34 33	5.9	32 25	6.1	30 7	6.2	27 39	6.4	25 0	6.6	22 9	6.8	19 4	7.0
32 30	38 59	5.5	37 19	5.6	35 33	5.7	33 38	5.8	31 35	6.0	29 22	6.1	27 0	6.3	24 27	6.5	21 42	6.6	18 44	6.8	15 33	7.1
33 0	36 15	5.5	34 32	5.6	32 42	5.7	30 43	5.9	28 36	6.0	26 19	6.1	23 52	6.3	21 13	6.5	18 23	6.7	15 19	6.9	12 0	7.1
33 30	33 30	5.5	31 44	5.6	29 50	5.7	27 47	5.9	25 36	6.0	23 15	6.2	20 42	6.3	17 58	6.5	15 2	6.7	11 52	7.0	8 26	7.2
34 0	30 45	5.5	28 55	5.6	20 58	5.8	24 51	5.9	22 35	6.0	20 9	6.2	17 32	6.3	14 42	6.6	11 40	6.7	8 23	7.0	4 50	7.2

(24)

DECLINATION 9 N

Lat. N.	40 H.A.	40 D.	41 H.A.	41 D.	42 H.A.	42 D.	43 H.A.	43 D.	44 H.A.	44 D.	45 H.A.	45 D.	46 H.A.	46 D.	47 H.A.	47 D.	48 H.A.	48 D.	49 H.A.	49 D.
Alt.	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	2h m s	s	2h m s	s
36 0	19 39	5.6	17 35	5.7	15 21	5.9	12 58	6.0	10 23	6.2	7 36	6.3	4 38	6.6	1 24	6.8	57 56	7.0	54 9	7.3
36 30	16 51	5.6	14 43	5.8	12 25	5.9	9 58	6.1	7 18	6.2	4 26	6.4	1 21	6.6	58 1	6.8	54 25	7.1	50 31	7.4
37 0	14 2	5.6	11 50	5.8	9 28	5.9	6 55	6.1	4 11	6.3	1 14	6.5	58 2	6.7	54 36	6.9	50 52	7.1	46 50	7.5
37 30	11 13	5.7	8 57	5.8	6 30	6.0	3 53	6.1	1 3	6.3	58 0	6.5	54 42	6.7	51 9	7.0	47 18	7.3	43 6	7.5
38 0	8 22	5.7	6 2	5.8	3 31	6.0	0 49	6.2	57 53	6.3	54 45	6.6	51 20	6.8	47 40	7.1	43 40	7.3	39 20	7.7
38 30	5 31	5.7	3 7	5.9	0 31	6.0	57 44	6.2	54 43	6.4	51 28	6.6	47 57	6.9	44 8	7.1	40 0	7.4	35 30	7.7
39 0	2 40	5.8	0 11	5.9	57 30	6.1	54 37	6.3	51 31	6.5	48 9	6.7	44 31	6.9	40 35	7.2	36 19	7.5	31 38	7.9
39 30	59 47	5.8	57 13	5.9	54 28	6.1	51 29	6.3	48 17	6.5	44 49	6.7	41 4	7.0	36 59	7.3	32 33	7.6	27 42	8.0
40 0	56 53	5.8	54 7	5.9	51 24	6.1	48 20	6.3	45 2	6.5	41 27	6.8	37 33	7.1	33 20	7.3	28 44	7.7	23 42	8.1

DECLINATION 9 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° '	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
26 0	59 33	6.6	57 26	6.7	55 10	6.9	52 42	7.1	50 3	7.4	47 11	7.6	44 5	7.9	40 43	8.2	37 3	8.5	33 3	8.9
26 30	54 16	6.6	54 4	6.8	51 42	7.0	49 8	7.2	46 22	7.4	43 23	7.7	40 9	8.0	36 38	8.3	32 48	8.6	28 37	9.0
27 0	52 58	6.6	50 41	6.8	48 13	7.0	45 33	7.2	42 40	7.5	39 33	7.7	36 10	8.0	32 30	8.3	28 30	8.7	24 8	9.1
27 30	49 40	6.7	47 17	6.8	44 42	7.0	41 56	7.3	38 56	7.5	35 42	7.8	32 10	8.1	28 21	8.4	24 10	8.8	19 36	9.2
28 0	46 20	6.7	43 52	6.9	41 11	7.1	38 18	7.3	35 11	7.6	31 48	7.8	28 8	8.1	24 9	8.5	19 47	8.9	15 1	9.3
28 30	43 0	6.7	40 25	6.9	37 39	7.1	34 39	7.4	31 24	7.6	27 53	7.9	24 4	8.2	19 54	8.6	15 21	9.0	10 22	9.4
29 0	39 38	6.7	36 58	7.0	34 5	7.2	30 58	7.4	27 35	7.7	23 55	8.0	19 57	8.3	15 36	8.7	10 52	9.1	5 39	9.5
29 30	36 16	6.8	33 29	7.0	30 29	7.2	27 15	7.5	23 44	7.7	19 56	8.1	15 47	8.4	11 16	8.8	6 19	9.2	0 54	9.6
30 0	32 52	6.8	29 59	7.0	26 52	7.2	23 30	7.5	19 52	7.8	15 54	8.1	11 35	8.5	6 52	8.9	1 42	9.3	2h 56 5	9.7

DECLINATION 10 N

Lat. N. Apt.	40 H.A.	40 D.	41 H.A.	41 D.	42 H.A.	42 D.	43 H.A.	43 D.	44 H.A.	44 D.	45 H.A.	45 D.	46 H.A.	46 D.	47 H.A.	47 D.	48 H.A.	48 D.	49 H.A.	49 D.	50 H.A.	50 D.
° '	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	2h m s	s
36 0	23 27	5.6	21 34	5.7	19 31	5.8	17 20	5.9	14 58	6.1	12 26	6.3	9 41	6.5	6 43	6.7	3 31	6.9	0 4	7.1	56 19	7.4
36 30	20 41	5.6	18 44	5.7	16 38	5.9	14 22	6.0	11 55	6.1	9 18	6.3	6 28	6.5	3 24	6.7	0 5	6.9	2 56 31	7.2	52 37	7.5
37 0	17 54	5.6	15 53	5.7	13 43	5.9	11 23	6.0	8 52	6.2	6 9	6.4	3 13	6.6	0 3	6.8	2 56 38	7.0	52 55	7.3	48 53	7.6
37 30	15 7	5.6	13 2	5.7	10 47	5.9	8 23	6.0	5 47	6.2	2 59	6.4	2 59 57	6.6	2 56 40	6.8	53 8	7.1	49 17	7.4	45 6	7.6
38 0	12 19	5.6	10 10	5.8	7 51	5.9	5 22	6.1	2 41	6.3	2 59 47	6.4	56 39	6.7	53 16	6.9	49 36	7.2	45 37	7.5	41 17	7.8
38 30	9 30	5.7	7 17	5.8	4 54	5.9	2 20	6.1	2 59 34	6.3	56 34	6.5	53 20	6.7	49 50	7.0	46 2	7.3	41 55	7.6	37 25	7.8
39 0	6 40	5.7	4 23	5.8	1 50	0.0	2 59 17	6.2	56 25	6.3	53 20	6.6	49 59	6.8	46 22	7.1	42 26	7.3	38 9	7.7	33 29	8.0
39 30	3 50	5.7	1 29	5.8	2 58 57	0.0	56 12	6.2	53 15	6.4	50 4	6.6	46 36	6.8	42 52	7.1	38 47	7.4	34 21	7.8	29 30	8.1
40 0	0 59	5.7	2 58 33	5.9	55 56	0.0	53 7	6.2	50 4	6.4	46 46	6.7	43 12	6.9	39 19	7.2	35 6	7.5	30 29	7.9	25 27	8.2

(27)

DECLINATION 10 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
26 0	4^h 38	6.5	4^h 2 45	6.7	4^h 0 42	6.9	3^h 58 39	7.1	3^h 56 7	7.3	3^h 53 32	7.5	3^h 50 44	7.8	3^h 47 41	8.1	3^h 44 23	8.3	3^h 40 46	8.7
26 30	1 24	6.5	59 25	6.7	57 17	6.9	54 58	7.1	52 29	7.3	49 47	7.6	46 51	7.8	43 40	8.1	40 13	8.4	36 26	8.8
27 0	58 8	6.6	56 4	6.7	53 51	6.9	51 26	7.1	48 50	7.4	46 1	7.6	42 57	7.9	39 38	8.2	36 1	8.5	32 1	8.8
27 30	54 52	6.6	52 42	6.8	50 23	7.0	47 52	7.2	45 9	7.4	42 13	7.7	39 1	7.9	35 33	8.3	31 46	8.6	27 38	8.9
28 0	51 34	6.6	49 22	6.8	46 55	7.0	44 18	7.2	41 28	7.5	38 23	7.7	35 4	8.0	31 26	8.3	27 29	8.7	23 10	9.0
28 30	48 16	6.6	45 56	6.8	43 25	7.0	40 41	7.3	37 45	7.5	34 33	7.8	31 4	8.0	27 18	8.4	23 10	8.8	18 39	9.1
29 0	44 57	6.7	42 32	6.9	39 54	7.1	37 4	7.3	34 0	7.6	30 40	7.9	27 3	8.1	23 6	8.5	18 48	8.9	14 5	9.3
29 30	41 38	6.7	39 6	6.9	36 22	7.1	33 25	7.4	30 13	7.6	26 45	8.2	22 59	8.2	18 52	8.6	14 23	9.0	9 27	9.4
30 0	38 17	6.8	35 40	7.0	32 49	7.2	29 45	7.4	26 25	7.7	22 49	8.0	18 53	8.2	14 36	8.7	9 54	9.1	4 45	9.5

DECLINATION 11 N

Lat. N Alt.	40 H.A.	D.	41 H.A.	D.	42 H.A.	D.	43 H.A.	D.	44 H.A.	D.	45 H.A.	D.	46 H.A.	D.	47 H.A.	D.	48 H.A.	D.	49 H.A.	D.	50 H.A.	D.
° ′	3h m s		3h m s		3h m s		3h m s		3h m s		3h m s		3h m s		3h m s		3h m s		3h m s		3h m s	
36 0	27 0	5.5	25 20	5.6	23 35	5.7	21 35	5.9	19 20	6.0	17 6	6.2	14 35	6.3	11 52	6.5	8 56	6.7	5 46	7.0	2 20	7.2
36 30	24 25	5.5	22 38	5.6	20 43	5.7	18 30	5.9	16 25	6.0	14 1	6.2	11 25	6.4	8 37	6.6	5 34	6.8	2 17	7.0	58 43	7.3
37 0	21 39	5.5	19 50	5.6	17 51	5.8	15 43	5.9	13 24	6.1	10 55	6.2	8 14	6.4	5 10	6.6	2 11	6.8	58 47	7.1	55 5	7.4
37 30	18 54	5.5	17 1	5.7	14 58	5.8	12 45	5.9	10 22	6.1	7 48	6.3	5 1	6.5	2 1	6.7	58 46	6.9	55 14	7.2	51 24	7.4
38 0	16 8	5.6	14 10	5.7	12 4	5.8	9 47	6.0	7 19	6.1	4 39	6.3	1 47	6.5	58 41	6.7	55 19	7.0	51 30	7.2	47 41	7.5
38 30	13 21	5.6	11 20	5.7	9 9	5.9	6 47	6.0	4 15	6.2	1 30	6.4	58 32	6.6	55 19	6.8	51 50	7.0	48 3	7.3	43 55	7.6
39 0	10 34	5.6	8 28	5.7	6 13	5.9	3 47	6.0	1 11	6.2	58 19	6.4	55 15	6.6	51 55	6.8	48 19	7.1	44 24	7.4	40 7	7.7
39 30	7 45	5.6	5 30	5.8	3 17	5.9	0 46	6.0	58 3	6.3	55 7	6.5	51 57	6.7	48 30	6.9	44 46	7.2	40 42	7.5	36 16	7.8
40 0	4 56	5.6	2 43	5.8	0 19	5.9	57 44	6.1	54 55	6.3	51 53	6.5	48 37	6.7	45 3	6.9	41 11	7.2	39 58	7.5	32 21	7.9

DECLINATION 11 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s
	4h		4h		4h		4h		4h		3h		3h		3h		3h		3h	
26 0	9 30	6.4	7 58	6.6	6 9	6.7	4 11	7.0	2 3	7.2	59 45	7.4	57 14	7.6	54 30	7.9	51 32	8.2	48 18	8.5
26 30	6 20	6.5	4 40	6.6	2 47	6.8	0 42	7.0	58 28	7.2	56 3	7.4	53 25	7.7	50 33	7.9	47 26	8.2	44 2	8.6
27 0	3 12	6.5	1 22	6.7	59 22	6.8	57 12	7.0	54 52	7.3	52 20	7.5	49 34	7.7	46 35	8.0	43 19	8.3	39 45	8.6
27 30	59 58	6.5	58 2	6.7	55 57	6.9	53 41	7.1	51 14	7.3	48 35	7.5	45 42	7.8	42 34	8.1	39 9	8.4	35 20	8.7
28 0	56 43	6.5	54 42	6.7	52 31	6.9	50 9	7.1	47 36	7.3	44 49	7.6	41 49	7.8	38 32	8.1	34 58	8.5	31 4	8.8
28 30	53 27	6.6	51 20	6.7	49 4	6.9	46 30	7.1	43 56	7.4	41 2	7.6	37 54	7.9	34 28	8.2	30 44	8.5	26 39	8.9
29 0	50 10	6.6	47 58	6.8	45 36	7.0	43 2	7.2	40 15	7.4	37 13	7.7	33 57	8.0	30 22	8.3	26 28	8.6	22 12	9.0
29 30	46 52	6.6	44 35	6.8	42 7	7.0	39 26	7.2	36 32	7.5	33 23	7.7	29 58	8.0	26 14	8.4	22 9	8.7	17 42	9.1
30 0	43 34	6.6	41 11	6.8	38 39	7.1	35 49	7.3	32 48	7.5	29 31	7.8	25 57	8.1	22 3	8.4	17 48	8.8	13 8	9.3
30 30	40 15	6.7	37 46	6.9	35 5	7.1	32 11	7.3	29 2	7.6	25 37	7.9	21 54	8.2	17 50	8.5	13 23	8.9	8 30	9.3
31 0	36 54	6.7	34 20	6.9	31 32	7.1	28 31	7.4	25 15	7.6	21 41	7.9	17 48	8.3	13 34	8.6	8 50	9.0	3 50	9.4

(30)

DECLINATION 12 N

Lat. N.	40 H.A.	D.	41 H.A.	D.	42 H.A.	D.	43 H.A.	D.	44 H.A.	D.	45 H.A.	D.	46 H.A.	D.	47 H.A.	D.	48 H.A.	D.	49 H.A.	D.	50 H.A.	D.
	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
36 0	30 46	5.4	29 11	5.5	27 33	5.7	25 44	5.8	23 40	5.9	21 39	6.1	19 21	6.3	16 52	6.4	14 12	6.6	11 17	6.8	8 9	7.1
36 30	28 3	5.4	26 27	5.6	24 43	5.7	22 50	5.8	20 48	6.0	18 30	6.1	16 14	6.3	13 40	6.5	10 53	6.7	7 52	6.9	4 37	7.1
37 0	25 20	5.5	23 40	5.6	21 52	5.7	19 55	5.8	17 49	6.0	15 33	6.2	13 5	6.3	10 26	6.5	7 33	6.7	4 20	7.0	2h 1 3	7.2
37 30	22 36	5.5	20 52	5.6	19 1	5.7	17 0	5.9	14 49	6.0	12 28	6.2	9 56	6.4	7 11	6.6	4 12	6.8	2h 0 58	7.0	2h 57 27	7.3
38 0	19 51	5.5	18 4	5.6	16 9	5.8	14 4	5.9	11 49	6.0	9 23	6.2	6 45	6.4	3 54	6.6	2h 0 49	6.8	57 28	7.1	53 50	7.3
38 30	17 6	5.5	15 16	5.7	13 10	5.8	11 7	5.9	8 48	6.1	6 17	6.3	3 33	6.4	2h 0 36	6.7	57 25	6.9	53 57	7.2	50 10	7.4
39 0	14 20	5.5	12 20	5.7	10 23	5.8	8 8	6.0	5 45	6.1	3 9	6.3	2h 0 20	6.5	57 17	6.7	53 59	7.0	50 23	7.2	46 28	7.5
39 30	11 34	5.6	9 36	5.7	7 29	5.7	5 11	6.0	2h 2 42	6.1	2h 0 0	6.3	57 6	6.5	53 56	6.7	50 31	7.0	46 47	7.3	42 44	7.6
40 0	8 47	5.6	6 45	5.7	4 34	5.9	2 11	6.0	2h 59 37	6.2	56 51	6.3	53 50	6.5	50 34	6.8	47 1	7.1	43 9	7.3	38 56	7.7

(31)

DECLINATION 12 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
27 0	8 11	6.4	6 33	6.6	4 47	6.8	2 52	7.0	0 47	7.2	58 30	7.4	56 3	7.5	53 22	7.9	50 26	8.2	47 15	8.5
27 30	4 58	6.4	3 15	6.6	1 24	6.8	59 23	7.0	57 12	7.2	54 49	7.4	52 14	7.6	49 25	8.0	46 21	8.3	43 0	8.6
28 0	1 45	6 5	59 56	6.6	58 0	6.8	55 54	7.0	53 36	7.2	51 6	7.5	48 24	7.7	45 27	8.0	42 14	8.3	38 43	8.7
28 30	58 31	6.5	56 38	6.7	54 36	6.9	52 23	7.1	49 59	7.3	47 23	7.5	44 33	7.8	41 27	8.1	38 5	8.4	34 24	8 8
29 0	55 16	6.5	53 18	6.7	51 10	6.9	48 52	7.1	46 21	7.3	43 37	7.6	40 40	7.8	37 20	8.1	33 54	8.5	30 3	8.8
29 30	52 1	6.6	49 57	6.7	47 44	6.9	45 19	7.1	42 41	7.4	39 51	7.6	36 45	7.9	33 22	8.2	29 41	8.6	25 39	8.9
30 0	48 45	6.6	46 36	6.8	44 16	7.0	41 45	7.2	39 1	7.4	36 3	7.7	32 49	8.0	29 17	8.3	25 26	8.7	21 13	9.0
30 30	45 27	6.6	43 13	6.8	40 48	7.0	38 10	7.2	35 19	7.5	32 13	7.7	28 51	8.0	25 9	8.3	21 8	8.8	16 43	9.1
31 0	42 9	6.7	39 49	6.8	37 18	7.0	34 34	7.2	31 35	7.5	28 21	7.8	24 50	8.1	20 50	8.4	16 47	8.9	12 10	9.2

DECLINATION 13 N

Lat. N. M.T.	40 H.A.	D.	41 H.A.	D.	42 H.A.	D.	43 H.A.	D.	44 H.A.	D.	45 H.A.	D.	46 H.A.	D.	47 H.A.	D.	48 H.A.	D.	49 H.A.	D.	50 H.A.	D.
	3h	s	3h	s	3h	s	3h	s	3h	s	3h	s	3h	s	3h	s	3h	s	3h	s	3h	s
36 0	34 18	5.4	32 55	5.5	31 25	5.6	29 40	5.7	28 0	5.9	26 5	6.0	24 0	6.2	21 44	0.3	19 18	6.5	16 39	6.7	13 47	6.9
36 30	31 36	5.4	30 10	5.5	28 30	5.6	26 54	5.7	25 4	5.9	23 4	6.0	20 55	6.2	18 34	0.4	16 2	6.5	13 17	6.7	10 19	7.0
37 0	28 54	5.4	27 24	5.5	25 47	5.0	24 2	5.8	22 7	5.9	20 3	6.1	17 49	6.2	15 23	0.4	12 40	6.6	9 55	6.8	6 49	7.0
37 30	26 11	5.4	24 39	5.0	22 58	5.7	21 8	5.8	19 10	6.0	17 1	6.1	14 42	6.3	12 11	6.4	9 28	6.6	6 31	6.9	3 18 (2)	7.1
38 0	23 28	5.4	21 52	5.0	20 8	5.7	18 14	5.8	16 11	6.0	13 58	6.1	11 34	6.3	8 58	6.5	6 9	0.7	3 5 (2)	6.9	59 45	7.2
38 30	20 45	5.5	19 5	5.0	17 17	5.7	15 19	5.8	13 12	6.0	10 55	6.2	8 20	0.4	5 44	6.5	2 48 (2)	0.7	59 38 (2)	7.0	59 11	7.2
39 0	18 1	5.5	16 17	5.0	14 25	5.7	12 24	5.0	10 12	6.0	7 50	6.2	5 15	0.4	2 28 (2)	0.0	59 20 (2)	0.8	56 9	7.0	52 34	7.3
39 30	15 16	5.5	13 29	5.0	11 33	5.7	9 28	5.9	7 12	0.1	4 44	6.2	2 4 (2)	0.4	59 11	0.6	56 3	0.9	52 38	7.1	48 55	7.4
40 0	12 31	5.5	10 40	5.7	8 41	5.8	6 31	5.9	4 10	0.1	1 37	6.2	58 52 (2)	0.4	55 53	0.7	52 37	6.0	49 5	7.2	45 14	7.4

(33)

DECLINATION 13 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
27 0	4h 0 13	6.4	4h 11 40	6.5	4h 10 7	6.7	4h 8 25	6.9	4h 6 35	7.1	4h 4 36	7.3	4h 2 23	7.5	4h 0 0	7.8	3h 57 24	8.0	3h 54 33	8.3
27 30	9 54	6.4	8 24	6.6	6 46	6.7	4 59	6.9	3 2	7.1	0 57	7.3	58 38	7.6	56 7	7.8	53 23	8.1	50 23	8.4
28 0	6 43	6.4	5 7	6.6	3 24	6.8	1 31	7.0	59 29	7.1	57 17	7.4	54 51	7.6	52 12	7.9	49 20	8.2	46 11	8.5
28 30	3 30	6.4	1 50	6.6	0 1	6.8	58 2	7.0	55 55	7.2	53 36	7.4	51 2	7.6	48 10	7.9	45 15	8.2	41 57	8.5
29 0	0 17	6.5	58 32	6.6	56 38	6.8	54 34	7.0	52 19	7.2	49 54	7.5	47 13	7.7	44 19	8.0	41 9	8.3	37 41	8.6
29 30	57 3	6.5	55 13	6.6	53 14	6.8	51 4	7.0	48 43	7.3	46 10	7.5	43 22	7.7	40 20	8.0	37 1	8.4	33 23	8.7
30 0	53 49	6.5	51 54	6.7	49 49	6.9	47 33	7.1	45 5	7.3	42 26	7.5	39 30	7.8	30 19	8.1	32 50	8.4	29 2	8.8
30 30	50 34	6.5	48 33	6.7	46 23	6.9	44 1	7.1	41 26	7.3	38 40	7.6	35 36	7.9	32 16	8.2	28 38	8.5	24 39	8.9
31 0	47 18	6.6	45 12	6.7	42 56	6.9	40 27	7.1	37 46	7.4	34 52	7.6	31 40	7.9	28 11	8.2	24 23	8.6	20 13	9.0

DECLINATION 14 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
App.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s ′	′	3h m s ′	′	3h m s ′	′	3h m s ′	′	3h m s ′	′	3h m s ′	′	3h m s ′	′	3h m s ′	′	3h m s ′	′	3h m s ′	′	3h m s ′	′
36 0	37 45	5.4	39 39	5.4	35 11	5.0	33 43	5.7	32 8	5.8	30 24	5.9	28 31	6.1	26 20	0.3	24 10	0.4	21 52	0.6	19 15	0.8
36 30	35 5	5.4	33 48	5.5	32 24	5.0	30 53	5.7	29 13	5.8	27 29	6.0	25 28	6.1	23 21	0.3	21 3	0.4	18 33	0.6	15 51	0.0
37 0	32 23	5.4	31 4	5.5	29 37	5.0	28 2	5.7	26 19	5.9	24 27	6.0	22 25	6.2	20 13	0.3	17 50	0.5	15 14	0.7	12 25	0.0
37 30	29 42	5.4	28 19	5.5	26 40	5.0	25 10	5.8	23 23	5.9	21 27	6.0	19 21	6.2	17 4	0.4	14 35	0.5	11 55	0.7	8 58	7.0
38 0	27 0	5.4	25 34	5.5	24 0	5.0	22 18	5.8	20 27	5.9	18 26	6.0	16 15	6.2	13 53	0.4	11 19	0.6	8 31	0.8	5 20	7.0
38 30	24 18	5.4	22 48	5.5	21 11	5.7	19 25	5.8	17 30	5.9	15 25	6.1	13 0	6.2	10 42	0.4	8 2	0.6	5 8	0.8	1 30	7.1
39 0	21 35	5.4	20 2	5.5	18 21	5.7	16 31	5.8	14 32	5.9	12 23	6.1	10 2	6.3	7 29	0.5	4 43	0.7	1 43	0.0	2 58 27	7.1
39 30	18 52	5.4	17 16	5.0	15 31	5.7	13 37	5.8	11 34	6.0	9 19	6.1	0 54	6.3	4 15	0.5	1 24	0.7	2 58 17	7.0	54 53	7.2
40 0	16 9	5.4	14 20	5.0	12 41	5.7	10 43	5.9	8 35	6.0	6 13	6.1	3 45	6.3	1 0	0.5	2 58 2	0.7	54 48	7.0	51 17	7.2

(35)

DECLINATION 14 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	4h		4h		4h		4h		4h		4h		4h		4h		4h		4h	
27 0	17 56	6.3	16 42	6.5	15 22	6.7	13 54	6.9	12 18	7.0	10 32	7.2	8 37	7.4	6 31	7.7	4 14	7.9	1 43	8.2
27 30	14 46	6.4	13 28	6.5	12 2	6.7	10 29	6.9	8 47	7.0	6 56	7.3	4 54	7.5	2 41	7.7	0 10	8.0	57 36	8.3
28 0	11 35	6.4	10 13	6.5	8 42	6.7	7 3	6.9	5 16	7.1	3 18	7.3	1 10	7.5	58 49	7.7	56 16	8.0	53 28	8.3
28 30	8 24	6.4	6 57	6.6	5 21	6.7	3 37	6.9	1 43	7.1	59 39	7.3	57 24	7.6	54 58	7.8	52 15	8.1	49 18	8.4
29 0	5 13	6.4	3 40	6.6	2 0	6.7	0 10	6.9	58 10	7.1	56 0	7.3	53 38	7.6	51 2	7.8	48 13	8.2	45 7	8.5
29 30	2 1	6.4	0 23	6.6	58 38	6.8	56 42	7.0	54 37	7.2	52 20	7.4	49 50	7.6	47 7	7.9	44 8	8.2	40 52	8.5
30 0	58 48	6.4	57 6	6.6	55 15	6.8	53 13	7.0	51 2	7.2	48 38	7.4	46 1	7.7	43 10	8.0	40 3	8.3	36 38	8.6
30 30	55 35	6.5	53 47	6.6	51 51	6.8	49 44	7.0	47 26	7.3	44 55	7.5	42 11	7.7	39 11	8.0	35 55	8.3	32 20	8.7
31 0	52 21	6.5	50 29	6.7	48 26	6.9	46 14	7.1	43 48	7.3	41 11	7.5	38 19	7.8	35 11	8.1	31 45	8.4	28 0	8.7
31 30	49 6	6.5	47 8	6.7	45 1	6.9	42 41	7.1	40 10	7.3	37 25	7.6	34 25	7.8	31 9	8.1	27 34	8.5	23 38	8.9
32 0	45 51	6.6	43 48	6.7	41 34	6.9	39 10	7.2	36 31	7.4	33 38	7.6	30 30	7.9	27 5	8.2	23 20	8.6	19 12	8.9
32 30	42 34	6.6	40 27	6.7	38 7	6.9	35 35	7.2	32 50	7.4	29 50	7.7	26 33	8.0	22 58	8.3	19 3	8.6	14 44	9.0
33 0	39 17	6.6	37 4	6.7	34 38	6.9	32 0	7.2	29 7	7.4	26 0	7.7	22 34	8.0	18 50	8.3	14 44	8.7	10 13	9.1

DECLINATION 15 N

Lat. N	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A. (3h)	D.	H.A. (3h)	D.	H.A. (3h)	D.	H.A. (3h)	D.	H.A. (3h)	D.	H.A. (3h)	D.	H.A. (3h)	D.	H.A. (3h)	D.	H.A. (3h)	D.	H.A. (3h)	D.	H.A. (3h)	D.
36 0	41 8	5.3	40 3	5.4	38 53	5.5	37 35	5.6	36 10	5.8	34 38	5.9	32 57	6.0	31 6	6.2	29 7	6.4	26 56	6.5	24 35	6.7
36 30	38 8	5.3	37 22	5.5	36 7	5.5	34 46	5.7	33 17	5.8	31 41	5.9	29 56	6.1	28 1	6.2	25 56	6.4	23 41	6.6	21 13	6.8
37 0	35 48	5.3	34 38	5.5	33 21	5.6	31 56	5.7	30 24	5.8	28 44	5.9	26 54	6.1	24 55	6.2	22 45	6.4	20 24	6.6	17 51	6.8
37 30	33 8	5.4	31 54	5.5	30 34	5.6	29 6	5.7	27 3	5.8	25 46	6.0	23 52	6.1	21 48	6.3	19 33	6.4	17 7	6.6	14 27	6.8
38 0	30 27	5.4	29 11	5.5	27 47	5.6	26 15	5.7	24 30	5.8	22 47	6.0	20 49	6.1	18 40	6.3	16 20	6.5	13 48	6.7	11 2	6.8
38 30	27 46	5.4	26 26	5.5	24 59	5.6	23 24	5.7	21 41	5.9	19 48	6.0	17 45	6.2	15 31	6.3	13 6	6.5	10 28	6.7	7 36	6.9
39 0	25 5	5.4	23 42	5.5	22 11	5.6	20 33	5.8	18 44	5.9	16 48	6.0	14 40	6.2	12 21	6.3	9 51	6.6	7 6	6.7	4 8	6.9
39 30	22 23	5.4	20 57	5.5	19 23	5.6	17 40	5.8	15 49	5.9	13 47	6.1	11 35	6.2	9 11	6.4	6 34	6.6	3 44	6.8	0 38	7.0
40 0	19 41	5.4	18 11	5.5	16 34	5.6	14 47	5.8	12 51	5.9	10 45	6.1	8 28	6.2	5 59	6.4	3 17	6.6	0 20	6.8	2 57 7	7.0

DECLINATION 15 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
29 0	4^h 10 4	6.4	4^h 8 44	6.5	4^h 7 16	6.7	4^h 5 40	6.9	4^m 3 55	7.0	^{3} 2 1	7.3	3^h 59 55	7.5	3^h 57 38	7.8	3^h 55 7	8.0	3^h 52 22	8.3
29 30	6 53	6.4	5 28	6.5	3 56	6.7	2 14	6.9	0 24	7.1	58 23	7.3	56 10	7.5	53 45	7.8	51 7	8.1	48 12	8.4
30 0	3 42	6.4	2 12	6.5	0 35	6.7	58 48	6.9	56 51	7.1	54 43	7.3	52 24	7.6	49 51	7.8	47 5	8.1	44 1	8.4
30 30	0 30	6.4	58 56	6.6	57 13	6.8	55 20	6.9	53 18	7.2	51 3	7.4	48 37	7.6	45 56	7.9	43 1	8.2	39 48	8.5
31 0	57 18	6.4	55 38	6.6	53 50	6.8	51 52	7.0	49 43	7.2	47 22	7.4	44 48	7.6	42 0	7.9	38 56	8.2	35 34	8.6
31 30	54 5	6.5	52 20	6.6	50 27	6.8	48 23	7.0	46 7	7.2	43 40	7.5	40 59	7.7	38 3	8.0	34 49	8.3	31 17	8.7
32 0	50 51	6.5	49 2	6.7	47 3	6.8	44 53	7.1	42 31	7.3	39 56	7.5	37 7	7.8	34 2	8.0	30 40	8.4	26 57	8.7
32 30	47 37	6.5	45 42	6.7	43 38	6.9	41 21	7.1	38 53	7.3	36 11	7.5	33 14	7.8	30 1	8.1	26 29	8.5	22 35	8.8
33 0	44 22	6.5	42 22	6.7	40 12	6.9	37 49	7.1	35 14	7.3	32 25	7.6	29 20	7.8	25 57	8.1	22 15	8.6	18 11	8.9

DECLINATION 16 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s
36° 0′	3h 44 26	5.3	3h 43 31	5.4	3h 42 30	5.5	3h 41 22	5.6	3h 40 7	5.7	3h 38 46	5.9	3h 37 16	6.0	3h 35 38	6.1	3h 33 51	6.3	3h 31 54	6.4	3h 29 46	6.6
36 30	41 47	5.3	40 49	5.4	39 45	5.5	38 34	5.6	37 16	5.7	35 50	5.9	34 17	6.0	32 34	6.1	30 42	6.3	28 41	6.5	26 28	6.7
37 0	39 8	5.3	38 7	5.4	37 0	5.5	35 45	5.6	34 24	5.8	32 54	5.9	31 17	6.0	29 30	6.2	27 34	6.3	25 26	6.5	23 8	6.7
37 30	36 29	5.3	35 25	5.4	34 14	5.5	32 57	5.7	31 31	5.8	29 58	5.9	28 16	6.0	26 25	6.2	24 24	6.4	22 11	6.5	19 47	6.7
38 0	33 49	5.3	32 42	5.4	31 28	5.5	30 7	5.7	28 39	5.8	27 1	5.9	25 15	6.1	23 19	6.2	21 13	6.4	18 55	6.6	16 25	6.8
38 30	31 9	5.3	29 59	5.4	28 42	5.6	27 18	5.7	25 45	5.8	24 4	5.9	22 13	6.1	20 13	6.2	18 2	6.4	15 38	6.6	13 2	6.8
39 0	28 29	5.4	27 10	5.5	25 55	5.6	24 27	5.7	22 51	5.8	21 6	6.0	19 11	6.1	17 6	6.3	14 49	6.4	12 20	6.6	9 38	6.9
39 30	25 48	5.4	24 32	5.5	23 8	5.6	21 37	5.7	19 57	5.9	18 7	6.0	16 8	6.1	13 58	6.3	11 36	6.5	9 1	6.7	6 12	6.9
40 0	23 7	5.4	21 48	5.5	20 21	5.6	18 46	5.7	17 1	5.9	15 8	6.0	13 4	6.2	10 48	6.3	8 21	6.5	5 40	6.7	2 45	7.0

DECLINATION 16 N

Lat. N.	50 H.A.	50 D.	51 H.A.	51 D.	52 H.A.	52 D.	53 H.A.	53 D.	54 H.A.	54 D.	55 H.A.	55 D.	56 H.A.	56 D.	57 H.A.	57 D.	58 H.A.	58 D.	59 H.A.	59 D.
Alt.	4h		4h		4h		4h		4h		4h		4h		4h		4h		3h	
29 0	14 51	6.3	13 43	6.5	12 28	6.6	11 5	6.8	9 35	7.0	7 55	7.2	6 0	7.4	4 5	7.6	1 53	7.9	59 28	8.2
29 30	11 41	6.3	10 29	6.5	9 9	6.7	7 41	6.8	6 5	7.0	4 19	7.2	2 23	7.4	0 16	7.7	57 56	8.0	55 22	8.2
30 0	8 31	6.3	7 14	6.5	5 49	6.7	4 16	6.8	2 34	7.0	0 42	7.2	58 40	7.5	56 25	7.7	53 57	8.0	51 15	8.3
30 30	5 21	6.4	3 59	6.5	2 29	6.7	0 51	6.9	59 3	7.1	57 5	7.3	54 55	7.5	52 33	7.8	49 57	8.0	47 6	8.4
31 0	2 10	6.4	0 43	6.6	59 8	6.7	57 24	6.9	55 31	7.1	53 25	7.3	51 9	7.5	48 40	7.8	45 56	8.1	42 55	8.4
31 30	58 58	6.4	57 26	6.6	55 47	6.7	53 57	6.9	51 57	7.1	49 46	7.3	47 23	7.6	44 46	7.9	41 53	8.2	38 43	8.5
32 0	55 46	6.4	54 11	6.6	52 25	6.8	50 29	6.9	48 23	7.2	46 6	7.4	43 35	7.7	40 49	7.9	37 48	8.2	34 29	8.5
32 30	52 34	6.5	50 53	6.6	49 2	6.8	47 1	7.0	44 48	7.2	42 24	7.4	39 45	7.7	36 52	8.0	33 42	8.3	30 13	8.6
33 0	49 20	6.5	47 34	6.6	45 38	6.8	43 31	7.0	41 12	7.2	38 41	7.5	35 55	7.8	32 53	8.0	29 33	8.3	25 54	8.7
33 30	46 6	6.5	44 15	6.7	42 13	6.9	40 0	7.0	37 35	7.3	34 56	7.5	32 2	7.8	28 52	8.1	25 23	8.4	21 33	8.8
34 0	42 52	6.5	40 55	6.7	38 48	6.9	36 29	7.1	33 56	7.3	31 10	7.6	28 8	7.8	24 49	8.2	21 10	8.5	17 10	8.9
34 30	39 37	6.5	37 35	6.7	35 21	6.9	32 56	7.1	30 17	7.4	27 23	7.6	24 13	7.9	20 44	8.2	16 55	8.6	12 43	9.0
35 0	36 21	6.5	34 13	6.7	31 54	6.9	29 22	7.1	26 36	7.4	23 34	7.6	20 15	7.9	16 37	8.3	12 37	8.7	8 13	9.1

DECLINATION 17 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
36 0	47 41	5.3	46 54	5.4	46 2	5.5	45 4	5.6	44 0	5.7	42 48	5.8	41 30	5.9	40 3	6.1	38 28	6.2	36 44	6.4	34 51	6.5
36 30	45 2	5.3	44 13	5.4	43 18	5.5	42 17	5.6	41 9	5.7	39 54	5.8	38 32	5.9	37 1	6.1	35 22	6.2	33 33	6.4	31 34	6.6
37 0	42 24	5.3	41 32	5.4	40 34	5.5	39 30	5.6	38 19	5.7	37 0	5.8	35 34	6.0	33 59	6.1	32 15	6.3	30 21	6.4	28 17	6.6
37 30	39 45	5.3	38 51	5.4	37 50	5.5	36 42	5.6	35 27	5.7	34 5	5.8	32 35	6.0	30 56	6.1	29 7	6.3	27 9	6.5	24 59	6.6
38 0	37 0	5.3	36 9	5.4	35 5	5.5	33 54	5.6	32 36	5.7	31 10	5.9	29 35	6.0	27 52	6.1	25 59	6.3	23 55	6.5	21 40	6.7
38 30	34 27	5.3	33 27	5.4	32 20	5.5	31 6	5.0	29 44	5.8	28 14	5.9	26 35	6.0	24 48	6.2	22 50	6.3	20 41	6.5	18 20	6.7
39 0	31 48	5.3	30 44	5.4	29 34	5.5	28 17	5.0	26 51	5.8	25 18	5.9	23 35	6.0	21 42	6.2	19 40	6.4	17 25	6.5	14 59	6.7
39 30	29 8	5.3	28 2	5.4	26 48	5.5	25 28	5.7	23 58	5.8	22 21	5.9	20 34	6.1	18 36	6.2	16 29	6.4	14 9	6.6	11 36	6.8
40 0	26 28	5.3	25 19	5.4	24 2	5.5	22 38	5.7	21 5	5.8	19 23	6.0	17 32	6.1	15 30	6.2	13 17	6.4	10 51	6.6	8 13	6.8

DECLINATION 17 N

Lat. N.	50 H.A.	50 D.	51 H.A.	51 D.	52 H.A.	52 D.	53 H.A.	53 D.	51 H.A.	51 D.	55 H.A.	55 D.	56 H.A.	56 D.	57 H.A.	57 D.	58 H.A.	58 D.	59 H.A.	59 D.
° ′	m s		m s		m s		m s		m s		m s		m s		m s		m s		m s	
	4h		4h		4h		4h		4h		3h		3h		3h		3h		3h	
31 0	6 57	6.3	5 43	6.5	4 21	6.7	2 51	6.8	1 12	7.0	59 23	7.3	57 23	7.5	55 11	7.7	52 46	8.0	50 6	8.2
31 30	3 47	6.4	2 28	6.5	1 1	6.7	59 26	6.9	57 41	7.0	55 45	7.3	53 39	7.5	51 20	7.8	48 47	8.0	45 59	8.3
			3		3		3		3											
32 0	0 36	6.4	59 13	6.5	57 41	6.7	56 0	6.9	54 9	7.0	52 7	7.3	49 54	7.6	47 27	7.8	44 46	8.1	41 49	8.4
	3																			
32 30	57 25	6.4	55 57	6.6	54 20	6.7	52 33	6.9	50 36	7.0	48 28	7.3	46 7	7.6	43 33	7.9	40 44	8.2	37 37	8.5
33 0	54 13	6.4	52 40	6.6	50 58	6.8	49 6	7.0	47 3	7.2	44 48	7.4	42 20	7.6	39 37	7.9	36 39	8.2	33 23	8.5
33 30	51 1	6.4	49 23	6.6	47 35	6.8	45 37	7.0	43 28	7.2	41 6	7.4	38 31	7.7	35 41	8.0	32 34	8.3	29 8	8.6
34 0	47 48	6.4	46 5	6.6	44 12	6.8	42 8	7.0	39 53	7.2	37 24	7.5	34 41	7.7	31 42	8.0	28 26	8.3	24 49	8.7
34 30	44 35	6.5	42 47	6.7	40 48	6.8	38 38	7.0	36 16	7.3	33 40	7.5	30 49	7.8	27 42	8.1	24 16	8.4	20 29	8.8
35 0	41 21	6.5	39 27	6.7	37 23	6.8	35 8	7.0	32 38	7.3	29 55	7.5	26 56	7.8	23 40	8.1	20 4	8.4	16 6	8.9

DECLINATION 18 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
36 0	50 51	5.2	50 14	5.3	49 31	5.4	48 42	5.5	47 48	5.7	46 47	5.8	45 39	5.9	44 24	6.0	43 1	6.2	41 29	6.3	39 49	6.5
36 30	48 14	5.3	47 33	5.3	46 48	5.4	45 56	5.5	44 58	5.7	43 54	5.8	42 42	5.9	41 23	6.0	39 56	6.2	38 20	6.4	36 34	6.5
37 0	45 36	5.3	44 53	5.4	44 4	5.4	43 9	5.5	42 8	5.7	41 0	5.8	39 45	5.9	38 22	6.1	36 50	6.2	35 9	6.4	33 19	6.5
37 30	42 57	5.3	42 12	5.4	41 21	5.5	40 23	5.6	39 18	5.7	38 7	5.8	36 48	5.9	35 20	6.1	33 44	6.2	31 59	6.4	30 3	6.6
38 0	40 20	5.3	39 31	5.4	38 37	5.5	37 36	5.6	36 28	5.7	35 13	5.8	33 50	6.0	32 18	6.1	30 38	6.3	28 47	6.4	26 47	6.6
38 30	37 41	5.3	36 50	5.4	35 33	5.5	34 48	5.6	33 37	5.7	32 18	5.8	30 51	6.0	29 16	6.1	27 30	6.3	25 35	6.4	23 29	6.7
39 0	35 3	5.3	34 9	5.4	33 8	5.5	32 1	5.6	30 46	5.7	29 23	5.8	27 52	6.0	26 12	6.1	24 23	6.3	22 22	6.5	20 11	6.7
39 30	32 24	5.3	31 27	5.4	30 23	5.5	29 13	5.6	27 54	5.7	26 28	5.9	24 53	6.0	23 8	6.1	21 14	6.3	19 8	6.5	16 51	6.7
40 0	29 45	5.3	28 45	5.4	27 38	5.5	26 24	5.6	25 2	5.7	23 32	5.9	21 53	6.0	20 4	6.1	18 4	6.3	15 54	6.5	13 30	6.7

(43)

DECLINATION 18 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° '	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s
30 0	17 58	6.3	17 4	6.4	16 5	6.6	14 58	6.7	13 44	6.9	12 23	7.2	10 51	7.3	9 10	7.0	7 19	7.8	5 10	8.1
30 30	14 49	6.3	13 52	6.5	12 47	6.6	11 36	6.8	10 16	6.9	8 48	7.2	7 11	7.4	5 23	7.6	3 24	7.8	1 13	8.1
31 0	11 40	6.3	10 38	6.5	9 29	6.6	8 12	6.8	6 48	7.0	5 13	7.2	3 30	7.4	1 35	7.6	59 29	7.9	57 9	8.1
31 30	8 31	6.3	7 25	6.5	6 11	6.6	4 49	6.8	3 18	7.0	1 38	7.2	59 48	7.4	57 47	7.7	55 33	7.9	53 5	8.2
32 0	5 22	6.3	4 11	6.5	2 52	6.7	1 25	6.8	59 48	7.0	58 2	7.2	56 5	7.5	53 57	7.7	51 35	8.0	48 58	8.3
32 30	2 12	6.4	0 56	6.5	59 32	6.7	58 0	6.9	56 18	7.1	54 25	7.2	52 21	7.5	50 6	7.8	47 36	8.0	44 50	8.3
33 0	59 1	6.4	57 41	6.5	56 12	6.7	54 34	6.9	52 46	7.1	50 48	7.3	48 37	7.5	46 13	7.8	43 35	8.1	40 41	8.4
33 30	55 51	6.4	54 25	6.5	52 51	6.7	50 18	6.9	49 14	7.1	47 9	7.3	44 51	7.6	42 20	7.8	39 33	8.1	30 30	8.4
34 0	52 39	6.4	51 9	6.5	49 30	6.7	47 41	6.9	45 41	7.1	43 29	7.4	41 4	7.6	38 25	7.9	35 30	8.2	32 17	8.5
34 30	49 28	6.4	47 53	6.6	46 8	6.7	44 13	7.0	42 7	7.2	39 48	7.4	37 16	7.7	34 29	7.9	31 24	8.2	28 1	8.7
35 0	46 15	6.4	44 35	6.6	42 45	6.8	40 44	7.0	38 32	7.2	36 6	7.4	33 26	7.7	30 31	8.0	27 17	8.3	23 41	8.7

DECLINATION 19 N

Lat. N	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
36 0	53 59	5.2	53 30	5.3	52 56	5.4	52 16	5.5	51 31	5.6	50 4	5.7	49 43	5.9	48 39	6.0	47 27	6.1	46 8	6.3	44 40	6.4
36 30	51 21	5.2	50 50	5.3	50 13	5.4	49 31	5.5	40 43	5.6	47 48	5.7	46 47	5.9	45 39	6.0	44 24	6.1	43 0	6.3	41 28	6.4
37 0	48 44	5.2	48 10	5.3	47 30	5.4	46 45	5.5	45 54	5.6	44 56	5.7	43 52	5.9	42 40	6.0	41 20	6.1	39 52	6.3	38 14	6.5
37 30	46 7	5.3	45 30	5.4	44 47	5.4	43 59	5.5	43 5	5.7	42 4	5.8	40 55	5.9	39 40	6.0	38 16	6.2	36 43	6.3	35 1	6.5
38 0	43 29	5.3	42 49	5.4	42 4	5.4	41 13	5.5	40 15	5.7	39 11	5.8	37 59	5.9	36 39	6.0	35 11	6.2	33 33	6.3	31 46	6.5
38 30	40 51	5.3	40 9	5.4	39 21	5.5	38 27	5.6	37 26	5.7	36 17	5.8	35 2	5.9	33 38	6.1	32 5	6.2	30 23	6.4	28 31	6.5
39 0	38 13	5.3	37 28	5.4	36 37	5.5	35 40	5.6	34 35	5.7	33 24	5.8	32 4	5.9	30 36	6.1	28 59	6.2	27 12	6.4	25 14	6.6
39 30	35 35	5.3	34 47	5.4	33 53	5.5	32 53	5.6	31 45	5.7	30 30	5.8	29 6	5.9	27 34	6.1	25 52	6.2	24 0	6.4	21 57	6.6
40 0	32 57	5.3	32 6	5.4	31 9	5.5	30 5	5.6	28 54	5.7	27 35	5.8	26 8	5.9	24 31	6.1	22 45	6.2	20 48	6.4	18 39	6.6

DECLINATION 19 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
40 30	30 18	5.3	29 24	5.4	28 24	5.5	27 17	5.6	26 2	5.7	24 40	5.8	23 8	6.0	21 28	6.1	19 37	6.3	17 34	6.5	15 21	6.6
41 0	27 39	5.3	26 43	5.4	25 40	5.5	24 30	5.6	23 11	5.7	21 45	5.9	20 9	6.0	18 24	6.2	16 28	6.3	14 20	6.5	12 1	6.7
41 30	25 0	5.3	24 1	5.4	22 55	5.5	21 41	5.6	20 19	5.7	18 49	5.9	17 9	6.0	15 19	6.2	13 18	6.4	11 5	6.5	8 40	6.7
42 0	22 21	5.3	21 19	5.4	20 10	5.5	18 52	5.6	17 27	5.8	15 52	5.9	14 8	6.1	12 13	6.2	10 7	6.4	7 49	6.6	5 17	6.7
42 30	19 42	5.3	18 37	5.4	17 24	5.5	16 3	5.7	14 34	5.8	12 55	5.9	11 6	6.1	9 7	6.2	6 56	6.4	4 32	6.6	1 54	6.8
43 0	17 2	5.3	15 54	5.4	14 38	5.6	13 13	5.7	11 40	5.8	9 57	5.9	8 4	6.1	6 0	6.3	3 43	6.5	1 13	6.7	2h 58 29	6.8
43 30	14 22	5.4	13 11	5.5	11 51	5.6	10 23	5.7	8 46	5.8	6 59	6.0	5 1	6.1	2 51	6.3	0 29	6.5	2h 57 53	6.7	2h 55 2	6.9
44 0	11 41	5.4	10 27	5.5	9 4	5.6	7 32	5.7	5 51	5.9	4 0	6.0	1 57	6.1	2h 59 42	6.3	2h 57 15	6.5	2h 54 33	6.7	2h 51 35	6.9

(46)

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s	4h m s	s
30 0	22 36	6.3	21 54	6.4	21 7	6.6	20 13	6.7	19 13	6.9	18 5	7.1	16 49	7.3	15 34	7.5	13 50	7.8	12 5	8.0
30 30	19 28	6.3	18 42	6.4	17 50	6.6	16 51	6.7	15 46	6.9	14 32	7.1	13 10	7.3	11 39	7.5	9 57	7.8	8 5	8.0
31 0	16 20	6.3	15 30	6.4	14 33	6.6	13 30	6.7	12 18	6.9	10 59	7.1	9 31	7.3	7 53	7.5	6 4	7.8	4 4	8.1
31 30	13 12	6.3	12 17	6.4	11 16	6.6	10 7	6.8	8 51	7.0	7 26	7.2	5 51	7.4	4 7	7.6	2 10	7.8	0 2	8.1
32 0	10 3	6.3	9 4	6.4	7 58	6.6	6 44	6.8	5 22	7.0	3 51	7.2	2 10	7.4	0 19	7.6	3h 58 15	7.9	3h 55 59	8.2
32 30	6 54	6.3	5 51	6.5	4 40	6.6	3 21	6.8	1 53	7.0	0 16	7.2	3h 58 29	7.4	3h 56 31	7.7	54 19	7.9	51 54	8.2
33 0	3 45	6.3	2 37	6.5	1 21	6.6	3h 59 57	6.8	3h 58 24	7.0	3h 56 41	7.2	54 47	7.5	52 41	7.7	50 22	8.0	47 48	8.2
33 30	0 35	6.3	3h 59 23	6.5	3h 58 2	6.7	56 32	6.8	54 53	7.0	53 4	7.2	51 3	7.5	48 50	7.7	46 23	8.0	43 41	8.3
34 0	3h 57 25	6.3	56 8	6.5	54 42	6.7	53 7	6.9	51 22	7.1	49 27	7.3	47 19	7.5	44 58	7.8	42 23	8.0	39 32	8.4
34 30	54 15	6.4	52 52	6.5	51 22	6.7	49 41	6.9	47 50	7.1	45 48	7.3	43 34	7.6	41 5	7.8	38 22	8.1	35 21	8.4
35 0	51 4	6.4	49 37	6.5	48 1	6.7	46 15	6.9	44 18	7.1	42 9	7.3	39 47	7.6	37 11	7.8	34 19	8.1	31 9	8.5

DECLINATION 20 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
40 0	36 4	5.3	35 23	5.4	34 36	5.5	33 42	5.6	32 41	5.7	31 33	5.8	30 16	5.9	28 52	6.1	27 18	6.2	25 35	6.4	23 41	6.5
40 30	33 26	5.3	32 42	5.4	31 52	5.5	30 55	5.6	29 51	5.7	28 39	5.8	27 19	5.9	25 50	6.1	24 12	6.2	22 24	6.4	20 24	6.6
41 0	30 48	5.3	30 1	5.4	29 8	5.5	28 8	5.6	27 0	5.7	25 45	5.8	24 21	6.0	22 48	6.1	21 5	6.3	19 12	6.4	17 7	6.6
41 30	28 10	5.3	27 20	5.4	26 24	5.5	25 21	5.6	24 10	5.7	22 50	5.8	21 22	6.0	19 45	6.1	17 57	6.3	15 59	6.5	13 49	6.6
42 0	25 31	5.3	24 39	5.4	23 40	5.5	22 33	5.6	21 18	5.7	19 55	5.8	18 23	6.0	16 41	6.1	14 49	6.3	12 45	6.5	10 29	6.7
42 30	22 53	5.3	21 58	5.4	20 55	5.5	19 45	5.6	18 27	5.7	17		15 23	6.0	13 37	6.2	11 40	6	9 31	6.5	7 9	6.7
43 0	20 14	5.3	19 16	5.3	18 10	5.5	16 56	5.6	15 35	5.8	14 4	5.9	12 23	6.0	10 32	6.2	8 30	6.4	6 15	6.5	3 47	6.8
43 30	17 35	5.3	16 34	5.4	15 25	5.5	14 8	5.7	12 42	5.8	11 7	5.9	9 22	6.1	7 26	6.2	5 19	6.4	2 59	6.6	2 0 24	6.8
44 0	14 55	5.3	13 51	5.4	12 39	5.5	11 18	5.7	9 49	5.8	8 10	5.9	6 20	6.1	4 20	6.2	2 7	6.4	2 59 41	6.5	57 0	6.8

DECLINATION 20 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	4h m s		4h m s		4h m s		4h m s		4h m s		4h m s		4h m s		4h m s		4h m s		4h m s	
30 0	27 11	6.2	26 40	6.4	26 5	6.5	25 24	6.7	24 37	6.9	23 43	7.0	22 42	7.3	21 33	7.5	20 15	7.7	18 48	7.9
30 30	24 4	6.2	23 29	6.4	22 49	6.5	22 3	6.7	21 11	6.9	20 12	7.1	19 4	7.3	17 49	7.5	16 25	7.7	14 50	8.0
31 0	20 56	6.2	20 18	6.4	19 33	6.5	18 42	6.7	17 45	6.9	16 40	7.1	15 27	7.3	14 5	7.5	12 34	7.7	10 51	8.0
31 30	17 49	6.3	17 5	6.4	16 17	6.6	15 21	6.7	14 18	6.9	13 8	7.1	11 48	7.3	10 20	7.5	8 42	7.8	6 52	8.0
32 0	14 41	6.3	13 53	6.4	13 0	6.6	11 59	6.7	10 51	6.9	9 35	7.1	8 9	7.3	6 34	7.5	4 49	7.8	2 51	8.0
32 30	11 33	6.3	10 41	6.4	9 43	6.6	8 37	6.8	7 24	7.0	6 1	7.1	4 30	7.3	2 48	7.6	0 55	7.8	3 58 50	8.1
33 0	8 24	6.3	7 28	6.4	6 25	6.6	5 14	6.8	3 55	7.0	2 27	7.1	0 50	7.4	3 59 1	7.6	3 57 1	7.9	54 47	8.1
33 30	5 16	6.3	4 15	6.5	3 7	6.6	1 51	6.8	0 27	7.0	3 58 53	7.2	3 57 8	7.4	55 13	7.6	53 5	7.9	50 43	8.2
34 0	2 6	6.3	1 1	6.5	3 59 40	6.6	3 58 28	6.8	3 56 58	7.0	55 17	7.2	53 26	7.4	51 24	7.6	49 8	7.9	46 38	8.2

(49)

DECLINATION 21 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
40 0	39 8	5.3	38 35	5.3	37 57	5.4	37 13	5.5	36 23	5.7	35 25	5.8	34 20	5.9	33 7	6.0	31 46	6.2	30 15	6.3	28 35	6.5
40 30	36 30	5.3	35 55	5.3	35 14	5.4	34 27	5.5	33 33	5.7	32 32	5.8	31 24	5.9	30 7	6.0	28 41	6.2	27 6	6.3	25 20	6.5
41 0	33 53	5.3	33 15	5.3	32 31	5.4	31 41	5.5	30 44	5.7	29 39	5.8	28 27	5.9	27 6	6.0	25 36	6.2	23 56	6.4	22 5	6.5
41 30	31 15	5.3	30 35	5.4	29 48	5.4	28 55	5.6	27 54	5.7	26 46	5.8	25 30	5.9	24 5	6.1	22 30	6.2	20 45	6.4	18 49	6.6
42 0	28 37	5.3	27 54	5.4	27 5	5.5	26 8	5.6	25 4	5.7	23 52	5.8	22 32	5.9	21 3	6.1	19 24	6.3	17 34	6.4	15 32	6.6
42 30	25 59	5.3	25 13	5.4	24 21	5.5	23 21	5.6	22 14	5.7	20 58	5.8	19 34	6.0	18 0	6.1	16 16	6.3	14 22	6.4	12 15	6.6
43 0	23 21	5.3	22 32	5.4	21 37	5.5	20 34	5.6	19 23	5.7	18 4	5.8	16 35	6.0	14 57	6.1	13 9	6.3	11 9	6.5	8 56	6.7
43 30	20 43	5.3	19 51	5.4	18 53	5.5	17 46	5.6	16 32	5.7	15 9	5.9	13 36	6.0	11 53	6.1	10 0	6.3	7 55	6.5	5 36	6.7
44 0	18 4	5.3	17 10	5.4	16 8	5.5	14 58	5.6	13 40	5.7	12 13	5.9	10 36	6.0	8 49	6.1	6 51	6.3	4 40	6.5	2 15	6.7

DECLINATION 21 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
30 0	31 43	6.2	31 25	6.4	31 1	6.5	30 32	6.7	29 58	6.8	29 18	7.0	28 31	7.2	27 38	7.4	26 36	7.6	25 26	7.9
30 30	28 36	6.2	28 13	6.4	27 45	6.5	27 12	6.7	26 33	6.8	25 47	7.0	24 55	7.2	23 55	7.4	22 47	7.7	21 30	7.9
31 0	25 29	6.2	25 2	6.4	24 30	6.5	23 52	6.7	23 7	6.8	22 17	7.1	21 18	7.2	20 12	7.4	18 57	7.7	17 33	7.9
31 30	22 22	6.2	21 51	6.4	21 14	6.5	20 31	6.7	19 42	6.9	18 45	7.1	17 41	7.2	16 29	7.5	15 7	7.7	13 36	8.0
32 0	19 15	6.3	18 39	6.4	17 58	6.5	17 10	6.7	16 16	6.9	15 14	7.1	14 4	7.3	12 45	7.5	11 16	7.7	9 37	8.0
32 30	16 7	6.3	15 28	6.4	14 42	6.6	13 49	6.7	12 49	6.9	11 42	7.1	10 26	7.3	9 0	7.5	7 25	7.8	5 38	8.0
33 0	13 0	6.3	12 16	6.4	11 25	6.6	10 28	6.7	9 22	6.9	8 9	7.1	6 47	7.3	5 15	7.5	3 32	7.8	1 37	8.0
33 30	9 52	6.3	9 3	6.4	8 8	6.6	7 6	6.8	5 55	6.9	4 36	7.1	3 8	7.3	1 29	7.6	2 59 39	7.8	2 57 36	8.1
34 0	6 44	6.3	5 51	6.4	4 51	6.6	3 43	6.8	2 27	6.9	1 2	7.1	2 59 28	7.4	2 57 42	7.6	2 55 45	7.9	53 34	8.1

DECLINATION 21 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	2h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s	2h m s	s
36 0	54 8	6.3	52 57	6.5	51 37	6.7	50 9	6.9	48 30	7.0	46 41	7.3	44 39	7.5	42 25	7.7	39 56	8.0	37 11	8.3
36 30	50 58	6.3	49 42	6.5	48 18	6.7	46 43	6.9	44 59	7.1	43 3	7.3	40 55	7.5	38 33	7.8	35 56	8.1	33 2	8.4
37 0	47 48	6.4	46 27	6.5	44 57	6.7	43 18	6.9	41 27	7.1	39 25	7.3	37 10	7.6	34 40	7.8	31 54	8.1	28 51	8.5
37 30	44 37	6.4	43 11	6.5	41 36	6.7	39 51	6.9	37 55	7.1	35 45	7.3	33 23	7.6	30 45	7.9	27 50	8.2	24 37	8.5
38 0	41 26	6.4	39 55	6.6	38 15	6.7	36 24	7.0	34 21	7.2	32 5	7.4	29 35	7.6	26 49	7.9	23 45	8.2	20 22	8.6
38 30	38 14	6.4	36 38	6.6	34 53	6.8	32 55	7.0	30 46	7.2	28 23	7.4	25 46	7.7	22 51	8.0	19 38	8.3	16 5	8.7
39 0	35 1	6.4	33 21	6.6	31 30	6.8	29 26	7.0	27 11	7.2	24 40	7.5	21 55	7.8	18 51	8.0	15 29	8.4	11 45	8.8
39 30	31 48	6.4	30 2	6.6	28 6	6.8	25 56	7.0	23 34	7.3	20 56	7.5	18 2	7.8	14 50	8.1	11 18	8.5	7 22	8.8
40 0	28 35	6.4	26 43	6.6	24 41	6.8	22 25	7.0	19 56	7.3	17 11	7.5	14 8	7.8	10 47	8.1	7 4	8.5	2 57	8.9

DECLINATION 22 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s		3h m s		3h m s		3h m s		3h m s		3h m s		3h m s		3h m s		3h m s		3h m s		3h m s	
40 0	42 7	5.2	41 44	5.3	41 15	5.4	40 40	5.6	40 0	5.6	39 13	5.7	38 18	5.8	37 17	6.0	36 7	6.1	34 49	6.3	33 22	6.4
40 30	39 30	5.2	39 4	5.3	38 33	5.4	37 11	5.6	37 11	5.6	36 21	5.7	35 23	5.9	34 18	6.0	33 4	6.1	31 41	6.3	30 10	6.4
41 0	36 53	5.2	36 25	5.3	35 50	5.4	34 23	5.6	34 23	5.6	33 29	5.7	32 27	5.9	31 18	6.0	30 0	6.1	28 33	6.3	26 56	6.5
41 30	34 16	5.2	33 45	5.3	33 8	5.4	31 34	5.6	31 34	5.6	30 37	5.8	29 31	5.9	28 18	6.0	26 56	6.2	25 24	6.3	23 42	6.5
42 0	31 38	5.2	31 5	5.3	30 25	5.4	28 45	5.6	28 45	5.6	27 44	5.8	26 35	5.9	25 18	6.0	23 51	6.2	22 15	6.3	20 28	6.5
42 30	29 1	5.2	28 25	5.4	27 42	5.4	25 55	5.6	25 55	5.6	24 51	5.8	23 38	5.9	22 17	6.0	20 46	6.2	19 5	6.4	17 12	6.5
43 0	26 23	5.2	25 44	5.4	24 59	5.5	23 6	5.7	23 6	5.7	21 58	5.8	20 41	5.9	19 16	6.0	17 40	6.2	15 54	6.4	13 56	6.6
43 30	23 46	5.3	23 4	5.4	22 15	5.5	20 16	5.7	20 16	5.7	19 4	5.8	17 44	6.0	16 14	6.1	14 33	6.2	12 42	6.4	10 39	6.6
44 0	21 8	5.3	20 23	5.4	19 31	5.5	17 25	5.7	17 25	5.7	16 10	5.8	14 45	6.0	13 11	6.1	11 26	6.2	9 30	6.4	7 21	6.6

(53)

DECLINATION 22 N

Lat. N	50		51		52		53		54		55		56		57		58		59	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
36 0	58 44	6.3	57 46	6.4	56 40	6.6	55 26	6.8	54 1	7.0	52 27	7.2	50 42	7.4	48 46	7.6	46 36	7.9	44 12	8.2
36 30	55 36	6.3	54 33	6.5	53 21	6.6	52 1	6.8	50 32	7.0	48 52	7.2	47 0	7.4	44 57	7.7	42 39	7.9	40 6	8.2
37 0	52 27	6.3	51 19	6.5	50 3	6.7	48 37	6.8	47 2	7.0	45 16	7.2	43 17	7.5	41 6	7.7	38 41	8.0	35 59	8.3
37 30	49 17	6.3	48 4	6.5	46 43	6.7	45 12	6.8	43 31	7.0	41 39	7.3	39 33	7.5	37 15	7.8	34 41	8.0	31 50	8.3
38 0	46 7	6.4	44 50	6.5	43 23	6.7	41 47	6.9	40 0	7.1	38 1	7.3	35 48	7.5	33 22	7.8	30 40	8.1	27 40	8.4
38 30	42 56	6.4	41 35	6.6	40 3	6.7	38 21	6.9	36 28	7.1	34 22	7.3	32 2	7.6	29 28	7.9	26 37	8.2	23 27	8.5
39 0	39 46	6.4	38 18	6.6	36 42	6.7	34 54	6.9	32 54	7.1	30 42	7.3	28 15	7.6	25 32	7.9	22 32	8.2	19 13	8.6
39 30	36 34	6.4	35 2	6.6	33 20	6.8	31 26	7.0	29 20	7.2	27 1	7.4	24 26	7.7	21 35	8.0	18 26	8.3	14 56	8.7
40 0	33 22	6.4	31 45	6.6	29 57	6 8	27 57	7.0	25 45	7.2	23 18	7.4	20 36	7.7	17 36	8.0	14 17	8.4	10 36	8.8

DECLINATION 23 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
° '	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
40 0	45 3	5.2	44 48	5.3	44 29	5.4	44 4	5.5	43 33	5.6	42 56	5.7	42 12	5.8	41 22	6.0	40 24	6.1	39 18	6.2	38 4	6.4
40 30	42 26	5.2	42 9	5.3	41 47	5.4	41 19	5.5	40 45	5.6	40 5	5.7	39 18	5.8	38 23	6.0	37 22	6.1	36 12	6.2	34 53	6.4
41 0	39 49	5.2	39 30	5.3	39 5	5.4	38 34	5.5	37 57	5.6	37 14	5.7	36 23	5.8	35 25	6.0	34 19	6.1	33 5	6.3	31 41	6.4
41 30	37 13	5.2	36 50	5.3	36 23	5.4	35 49	5.5	35 9	5.6	34 22	5.7	33 28	5.8	32 26	6.0	31 16	6.1	29 57	6.3	28 29	6.4
42 0	34 36	5.2	34 11	5.3	33 41	5.4	33 4	5.5	32 21	5.6	31 30	5.7	30 33	5.9	29 27	6.0	28 13	6.1	26 49	6.3	25 16	6.4
42 30	31 58	5.2	31 31	5.3	30 58	5.4	30 18	5.5	29 32	5.6	28 38	5.7	27 37	5.9	26 27	6.0	25 9	6.1	23 41	6.3	22 3	6.5
43 0	29 21	5.2	28 52	5.3	28 16	5.4	27 33	5.5	26 43	5.6	25 46	5.7	24 41	5.9	23 27	6.0	22 5	6.2	20 32	6.3	18 49	6.5
43 30	26 44	5.2	26 12	5.3	25 33	5.4	24 47	5.5	23 54	5 6	22 53	5.7	21 44	5 9	20 27	6.0	19 0	6 2	17 22	6.3	15 34	6.5
44 0	24 7	5.2	23 32	5.3	22 5	5.4	22 1	5.5	21 5	5.6	20 0	5.7	18 48	5.9	17 26	6.0	15 54	6.2	14 12	6.3	12 18	6.5

DECLINATION 23 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	4h m s	s	4h m s	s	4h m s	s	4h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
36 0	3 17	6.3	2 31	6.4	1 37	6.6	0 36	6.7	59 26	6.9	58 8	7.1	56 39	7.3	55 0	7.6	53 9	7.8	51 4	8.1
36 30	0 9	6.3	3 59 18	6.4	3 58 20	6.6	3 57 14	6.8	55 59	7.0	54 34	7.1	52 59	7.4	51 13	7.6	49 14	7.8	47 1	8.1
37 0	3 57 1	6.3	56 5	6.4	55 2	6.6	53 51	6.8	52 30	7.0	51 0	7.2	49 18	7.4	47 25	7.6	45 19	7.9	42 57	8.2
37 30	53 52	6.3	52 52	6.4	51 44	6.6	50 28	6.8	49 1	7.0	47 25	7.2	45 37	7.4	43 36	7.7	41 22	7.9	38 52	8.2
38 0	50 43	6.3	49 39	6.5	48 26	6.6	47 4	6.8	45 32	7.0	43 49	7.2	41 54	7.4	39 46	7.7	37 24	8.0	34 46	8.3
38 30	47 34	6.3	46 25	6.5	45 7	6.7	43 39	6.8	42 2	7.0	40 12	7.2	38 11	7.5	35 55	7.7	33 25	8.0	30 37	8.3
39 0	44 24	6.3	43 10	6.5	41 47	6.7	40 14	6.9	38 31	7.1	36 35	7.3	34 26	7.5	32 3	7.8	29 24	8.1	26 27	8.4
39 30	41 14	6.3	39 55	6.5	38 27	6.7	36 48	6.9	34 59	7.1	32 56	7.3	30 41	7.6	28 10	7.9	25 22	8.1	22 15	8.4
40 0	38 4	6.3	36 40	6.5	35 7	6.7	33 22	6.9	31 26	7.1	29 17	7.3	26 54	7.6	24 14	7.9	21 18	8.2	18 1	8.5

DECLINATION 24 N

Lat. N.	40 H.A.	40 D.	41 H.A.	41 D.	42 H.A.	42 D.	43 H.A.	43 D.	44 H.A.	44 D.	45 H.A.	45 D.	46 H.A.	46 D.	47 H.A.	47 D.	48 H.A.	48 D.	49 H.A.	49 D.	50 H.A.	50 D.
Alt. ° ′	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s	3h m s	s
40 0	47 55	5.2	47 50	5.3	47 39	5.4	47 23	5.5	47 2	5.6	46 35	5.7	46 1	5.8	45 22	5.9	44 35	6.0	43 41	6.2	42 40	6.3
40 30	45 19	5.2	45 10	5.3	44 57	5.4	44 39	5.5	44 14	5.6	43 44	5.7	43 8	5.8	42 24	5.9	41 34	6.0	40 36	6.2	39 30	6.3
41 0	42 42	5.2	42 31	5.3	42 16	5.4	41 54	5.5	41 27	5.6	40 54	5.7	40 14	5.8	39 27	5.9	38 33	6.1	37 30	6.2	36 20	6.3
41 30	40 5	5.2	39 52	5.3	39 34	5.4	39 10	5.5	38 39	5.6	38 3	5.7	37 19	5.8	36 29	5.9	35 31	6.1	34 24	6.2	33 9	6.4
42 0	37 29	5.2	37 13	5.3	36 52	5.4	36 25	5.5	35 52	5.6	35 12	5.7	34 25	5.8	33 31	6.0	32 29	6.1	31 18	6.2	29 58	6.4
42 30	34 52	5.2	34 34	5.3	34 10	5.4	33 40	5.5	33 4	5.6	32 21	5.7	31 30	5.8	30 32	6.0	29 26	6.1	28 11	6.3	26 46	6.4
43 0	32 15	5.2	31 54	5.3	31 28	5.4	30 55	5.5	30 16	5.6	29 29	5.7	28 35	5.8	27 33	6.0	26 23	6.1	25 3	6.3	23 34	6.4
43 30	29 38	5.2	29 15	5.3	28 46	5.4	28 10	5.5	27 27	5.6	26 38	5.7	25 40	5.9	24 34	6.0	23 20	6.1	21 55	6.3	20 21	6.5
44 0	27 1	5.2	26 35	5.3	26 3	5.4	25 25	5.5	24 39	5.6	23 46	5.7	22 44	5.9	21 35	6.0	20 16	6.1	18 47	6.3	17 7	6.5

DECLINATION 24 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s	m s	s
36 0	4h 7 46	6.2	4h 7 12	6.4	4h 6 31	6.6	4h 5 42	6.7	4h 4 47	6.9	4h 3 43	7.1	4h 2 30	7.3	4h 1 7	7.5	3h 59 34	7.7	3h 57 49	8.0
36 30	4 39	6.3	4 0	6.4	3 14	6.6	2 21	6.7	1 20	6.9	6 11	7.1	58 51	7.3	57 22	7.5	55 42	7.8	53 49	8.1
37 0	1 31	6.3	0 48	6.4	59 58	6.6	59 0	6.7	57 53	6.9	56 38	7.1	55 12	7.3	53 36	7.5	51 48	7.8	49 47	8.1
37 30	58 23	6.3	57 36	6.4	56 41	6.6	55 38	6.8	54 26	6.9	53 5	7.1	51 33	7.4	49 50	7.6	47 54	7.8	45 45	8.1
38 0	55 15	6.3	54 24	6.4	53 23	6.6	52 15	6.8	50 58	7.0	49 31	7.2	47 52	7.4	46 2	7.6	43 59	7.9	41 42	8.2
38 30	52 7	6.3	51 10	6.4	50 6	6.6	48 52	6.8	47 29	7.0	45 56	7.2	44 11	7.4	43 14	7.6	40 3	7.9	37 37	8.2
39 0	48 58	6.3	47 57	6.5	46 48	6.6	45 29	6.8	44 0	7.0	42 21	7.2	40 29	7.4	38 25	7.7	36 6	8.0	33 31	8.2
39 30	45 49	6.3	44 43	6.5	43 29	6.6	42 5	6.8	40 30	7.0	38 44	7.2	36 46	7.5	34 34	7.7	32 7	8.0	29 23	8.3
40 0	42 40	6.3	41 29	6.5	40 10	6.6	38 40	6.8	37 0	7.0	35 7	7.2	33 2	7.5	30 42	7.7	28 7	8.0	25 14	8.3

BESSEL'S REFRACTIONS.

Alt.	Ref'n.	Alt.	Ref'n
24	2 8.9	35	1 22.3
25	2 3.2	36	1 19.3
26	1 57.8	37	1 16.5
27	1 52.8	38	1 13.8
28	1 48.2	39	1 11.2
29	1 43.8	40	1 8.7
30	1 39.7	41	1 6.3
31	1 35.8	42	1 4.0
32	1 32.1	43	1 1.8
33	1 28.7	44	0 59.7
34	1 25.4		

The Parallax may be taken as 7″ throughout.

ERRATA.

Page 5, line 16, for 25.3 × 5.4 read 25.3 × 4.5

" 11, Lat. 58, Alt. 27° 30′ for $\overset{m\ s}{21\ 58}$ read $\overset{m\ s}{21\ 15}$

" 12, " 41, " 33 30 " 6 3 " 6 30

" 14, " 50, " 30 30 " 59 49 " 59 39

" 15, " 50, " 27 30 " 21 40 " 21 48

" 16, " 40, " 32 to 34 for $\begin{matrix}6.7\\6.7\\6.7\\6.8\\6.8\end{matrix}$ read $\begin{matrix}5.7\\5.7\\5.7\\5.8\\5.8\end{matrix}$

" 26, " 50, " 26° 30′ for $\overset{m\ s}{54\ 16}$ read $\overset{m\ s}{56\ 16}$

" 30, " 53, " 28 30 " 46 30 " 46 36

" 35, " 45, " 40 " 6 13 " 6 15

" 37, " 40, " 36 30 " 38 8 " 38 28

" 42, " 54, " 31 30 to 32° 30′ for 7.0 read 7.1

" 43, " 42, " 38 30 for $\overset{m\ s}{35\ 33}$ read $\overset{m\ s}{35\ 53}$

" 45, " 44, " 36 30 " 40 43 " 48 43